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The Cary Individual Signal.

If there is one branch of electrical invention which since the introduction of the telephone has been more prolific than others, it is that of telephonic apparatus and systems of signaling.

Subdividing this branch into twigs, it is found that the "individual signal" is one of the favorite strings for the chronic inventor to harp on. The reason for this is evident. The problem, when first contemplated, seems a difficult one, and therefore is attractive.

It is, moreover, clear that a large number of subscribers to exchanges can be secured among a class which is at present very disproportionately represented—*i. e.*, the residences. In our smaller cities and towns there are also many small dealers and storekeepers who would take a telephone, if the price at which the exchange could afford to rent them was commensurate with their ideas, and if with the negative advantage of a low rental they could secure the positive advantage of a line practically private and exclusive.

This, then, is the prospect presented by a perfect or even an approximately perfect individual signal; and the prospective reward offered for such a signal has stimulated considerable inventive power—a fact proved by the hundred or more individual signals which, since January, 1879, have escaped from the prison-house of the Patent Office. Some of these work, or don't work, as the case may be, by means of successive impulses of current electricity sent from the central office. These, by the alternate magnetization and demagnetization of an electro-magnet and the consequent alternate attraction and withdrawal of an armature, propel a ratchet wheel and shaft; and at the proper position, differing for each instrument, a notch is presented to the bell hammer, allowing it, although at all other times locked, to advance and strike the bell. This was one of the first types let loose upon an innocent and confiding public. It ran its race in a few short months, and rests in oblivion. Another idea, and one of the most promising, is a circuit wheel, also propelled by a step-by-step movement, and adapted at a definite period to close a local circuit including a bell, and thus to ring up the proper person. Still a third type is that utilizing the harmonic principle. This comprises a set of bells having electro-magnets and spring armatures, each adjusted to a different rate of vibration. A caller is fixed at the central station, which is capable of making and breaking the circuit a definite number of times per second, and which can be made adjustable, so as to correspond with the rate of vibration of any one of the bells.

But time would fail to tell of all the individual bells that up to the present time have been placed to a greater or less extent before the telephonic public.

Some of these systems have experienced an utter failure. Others have met with a measurable degree of success, but the whole business, so far, seems to be a good deal like the scriptural story of the sower who went forth to sow. There's a great many more individual signals that have fallen by the wayside, or among thorns, or in stony places, than have brought forth fruit, even thirty-fold—and yet there is room.

For, although the telephone superintendent, after trying several of the individual systems which have from time to time been brought before him, has been induced to assert, in the bitterness of his heart, that "the only reliable individual signal is an individual line," and although we can most certainly agree with him, so far as business places, especially in our large cities, are concerned, yet it is a positive fact that there is just as much of a field for a good individual signal as ever, in small exchange systems, and for residences even in the largest of our cities.

It is, therefore, a good thing that enterprising invention still attempts to produce a first-class individual signal—one that always calls up the party wanted; what is equally important, one that never calls up the man who is not wanted; one that does not ring up two subscribers at one time; that has convenient and reliable means to bring all the instruments to a zero point together; and finally, a working arrangement that always shows the line to be in use when it *is* in use, and that never unblushingly makes that assertion when such is not the case. All of these virtues are claimed for the signal whose name precedes this article.

The Cary signal is, as a whole, quite a new device, although it includes many of the best features and elements of the older ideas. The entire apparatus is small, compact, simple and strong, and recommends itself to telephone managers by reason of the little skill required to place, connect and adjust it, while the entire space occupied by it is less than that taken up by a Blake transmitter.

Figure 1 represents the form of instrument adopted for use in subscribers' stations, and Fig. 2 shows the same as it appears with the external case removed to show the mechanism or to adjust the same.

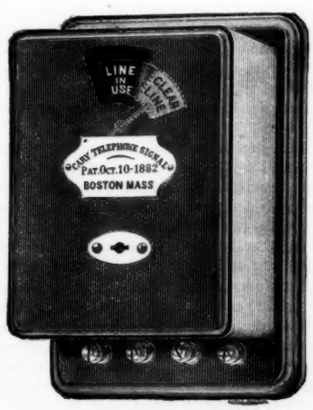

FIG. 1.

Externally, as shown in Fig. 1, all that is seen is a neat case, with an aperture at its upper part showing, when the line is free, a shield bearing the words, "Clear line"; while when any subscriber is conversing, the shield moves to one side, and exhibits the words, "Line in use." Four binding screws for attaching the wires are fixed to the base-board, two being for the main line wires, and the remaining two for the wires leading to the magneto bell or local circuit, depending upon the character of system adopted.

The working parts, which are clearly shown in the annexed figure 2, consist of an electro-magnet in the main line circuit, provided with a neutral or soft iron armature, carrying and actuating a light rod or lever, furnished at its upper end with a pawl jointed to it, and adapted to operate a ratchet wheel, and thus to rotate the shaft or arbor

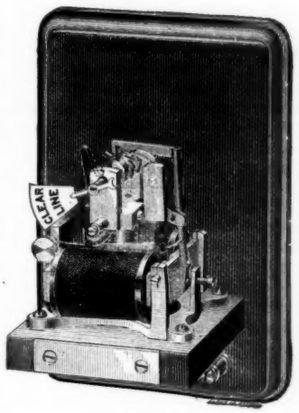

FIG. 2.

upon which the ratchet wheel is fixed. Of course, the ratchet wheel moves by means of the pawl the extent of one tooth, with each electrical pulsation.

The armature lever in addition to the above, moves also simultaneously with its pawl, and by means of an ingenious cam device, a detent lever, which engages a second ratchet wheel on the shaft, but toothed in a direction opposite to the first, and by such engagement prevents what has sometimes occurred in other step-by-step signals, *i. e.*, the advance of the ratchet wheel of more than one tooth, with a single pulsation.

This is a most important feature and adds much to the certainty of the operation.

Upon the same shaft that carries the two ratchet wheels is also fixed a rotating metallic disk, having at one point on its edge a non-conducting space, produced either by an actual depression, or by a piece of some good conductor let into the edge. This is fastened on by a set screw, and operates as a circuit changer, or shunt circuit breaker. A contact spring is adjusted to bear firmly upon the edge of the disk at all times, except when its bearing part, in the rotation of the disk, comes opposite the non-conducting part or depression in the edge. A second contact spring rests constantly in contact with the shaft, and the two springs together with the metal disk, act as a cut out or short circuit round the ringer, which may be and usually is, the ordinary magneto bell; and at all times, all the bells on the circuit are cut out, except the one which is being called; and that one is introduced into the main circuit, when at that station the short circuit round it is broken, by means of the passage of the depression of the metal disk under the first contact spring; so that the contact between the disk and the spring is for the time broken.

By means of the set screw, the circuit breaker may be adjusted upon the shaft, so as to break the short circuit and thus effect the signal at any desired point in its revolution. The system is operated by sending to line successive impulses of constant direction or polarity; say positive, which may be developed either from a battery or a magneto generator, although the latter is usually preferred, because it requires less care, is cleaner, is more powerful, and takes up less room. If, however, such a generator is used, it must be provided with a commutator, so as to send straight currents when required. As soon as a suitable number of constant currents have been sent to line, to bring the desired bell into circuit, the bell is rung by sending a regular magneto alternating current; and the same machine which is fitted with the commutator to furnish the constant currents, may readily be adopted by a special arrangement of wires to furnish also the alternating currents.

Not only, however, is this apparatus adopted to ring the magneto bell. By a slight modification in the metallic circuit changing disk, it is fitted to close the circuit of a local battery, and thus ring a vibrating bell.

As already indicated, it is most essential that a common zero point, or unison, be provided in instruments that have a progressive or step-by-step character of advance, in order that if any of the distant instruments be thrown out of correspondence with the rest, (whether by lightning discharge, or by a cross with a battery wire, or by the experimental researches of the subscriber), it may be brought back into correspondence by a simple operation performed at the central station. This is done in the Cary instrument

FIG. 3.

by a simple device. At a suitable place upon the revolving shaft a projecting pin is fixed.

In all the instruments, the pin is fixed at the same point. A pivoted magnetized bar of steel, technically called a polarized armature, hangs between the electro-magnet

cores and responds to changes in direction of current, although not to make and break signals. When the currents transmitted are of the direction which is used to advance the signals, they also act upon the polarized armature and tend to swing its free end into the path of the pin on the revolving shaft, so that as soon as the shafts of all the signals reach that point, they are stopped, and can go no further, no matter if the pulsations are continued; so that if from any reason one or more of the bells get behind the others, they are all brought together again when the pin of each reaches the polarized lever; and this occurs each time the line is used. It is when the instruments are thus at unison, that the "line in use signal" appears at the aperture, and the method of operation adopted in signaling is: first to send the requisite number of pulsations to call any individual instrument of the series; and after thus attracting the attention of the subscriber, to inform him what is wanted, and then before he commences his conversation, to run the instruments round to complete their revolution, so as to show the "line in use" signal. This signal is marked on a dial, and a second visual signal, *i. e.*, "line clear" is fixed at one end of a pointer which rotates with the shaft. This is brought into view, and remains opposite the aperture at all times when the line is not occupied.

The apparatus is released from unison by a single electrical pulsation of the direction opposite to that used to advance the signals; this acting to swing the polarized lever out of the way of the pin. The entire apparatus has worked well with the magneto bells of all the authorized manufacturers not only on the wall of an experimenting room, as is too frequently the case, but also on actual working lines.

Ordinarily they are arranged to allow six stations on a line, as experience shows that not more than that number of telephones can usually work harmoniously together, but in those rare cases where more than six are wanted, as in long lines which are rarely used, the number can readily be doubled, without change in the dials or mechanism; and if at any time it should be deemed advisable to crowd the line to such an extent, even fourteen stations can be provided for. There is nothing slow about this signal, since in trials made it has been found a very easy thing to call the last station on the line in three seconds. There is no clockwork to wind up; nor is there any delicate mechanism too fragile to be looked at in the device, but every part is solid and strong.

Some of the most important features are protected by the patents, granted and pending, of Mr. James H. Cary, who has also recently produced an automatic calling apparatus, which rings the desired bell without giving the central office operator the trouble and responsibility of counting.

At the central station, for the information of the operator, a duplicate instrument is usually placed, which, as shown on Fig. 3, has an index pointer and dial, by which the movements of the mechanism are visually indicated to the operator.

These signals are undoubtedly eminently adapted for work on long lines, or through lines of high resistance, on account of their adaptation for the employment of the magneto currents in all their functions.

A large number of the instruments are now being manufactured for the Cary Company by the Western Electric Company, arrangements for that purpose having been made with the American Bell Telephone Company.

A company has been organized to introduce these signals, its corporate name being the "Cary Telephone Signal Company," with officers as follows: J. P. Gale, President; Frederick Taylor, Treasurer; Jas. H. Cary, Electrician; Geo. H. Cary, General Agent. Their office is 246 Washington street, Boston.

What is Carbon?

M. Berthelot, in the *Journal de Pharmacie et de Chimie* for March, states that from peculiar physical relations he is led to suspect that the true element carbon is unknown, and that diamond and graphite are substances of a different order. Elementary carbon ought to be gaseous at the ordinary temperature, and the various kinds of carbon which occur in nature are in reality polymerised products of the true element carbon. Spectrum analysis is thought to confirm this view; and it is supposed the second spectrum seen in a Geissler tube belong to gaseous carbon. This spectrum, which has been recognized along with that of hydrogen in the light of the tails of comets, indicates a carbide, probably acetylene.

On the Theory of Electro-magnetic Machines.

By M. Joubert.

The experiments made by M. Tresca on the machines of M. Deprez, give for the first time in a precise form the measure of the phenomenon already known but not explained, that there is a loss of work in the machine in addition to that which is the consequence of Joule's law.

This loss has been ascribed to different causes, but as far as I am aware, the following, which is in my opinion by far the most important, has not been pointed out.

All the so-called "continuous current" machines are formed by a certain number of elements, such as the coils of Gramme's ring, which, *e.g.* in the case of a machine acting as recipient, pass from a position where the potential energy has a maximum value, W_0, to another diametrically opposite, of the minimum value W_1. The difference, $W_0 - W_1$, represents the electro-magnetic work performed by the coil in passing from the first position to the second. In order that the work may continue, it is necessary at this moment to reverse the direction of the current in the coil, that is to say, to destroy in pure loss the electric energy which it possesses and restore to it entirely the primitive energy, W_0. The operation is repeated for each coil twice per revolution. Making abstraction of the work of the resistance, the yield is therefore

$$\frac{W_0 - W_1}{W_0}$$

It is easy to determine the lower limit of the electric energy which is thus sacrificed at each half revolution, which is manifested, in part, at least, in the form of a spark. If we call I_1 the intensity of the current at the moment when it is destroyed in the coil, and l its coefficient of self-induction, the value of this loss is

$$\frac{l I_1}{2}.$$

If the ring is composed of p coils, and if it makes n revolutions per second, the loss in each unit of time is, therefore, at the minimum of $n\,p\,l\,I_1^2$, or $n\,L\,I_1^2$, when L stands for the coefficient of self-induction of the entire ring.

It is known experimentally that in the recipient machine the change of the direction of the current must take place before the coil passes by the line of the poles. The position of the commutator, or the brushes, is given analytically by the condition that the electromagnetic work $W_0 - W_1$ is the maximum.

All the coefficients which intervene in the equations may be determined directly. The verification of the theory is therefore relatively easy. I have been happy to find an indirect confirmation in the figures published by M. Tresca; the value thence deduced for the coefficient of self-induction of the machines of M. Deprez is quite within the limits of magnitude which correspond to this kind of machines.

M. Trouvé in his improved electric battery takes 150 grammes of bichromate of potash powder to a like amount of water, and after slaking, adds, drop by drop, 450 grammes of sulphuric acid. The liquid warms and the salt dissolves, while no crystals are formed on cooling, nor are chrome alum crystals deposited in the cell. The elements are arranged with two carbons to each zinc, the latter being so placed that it can be drawn from the solution. With 12 elements and the solution above described it is stated that 10 incandescent lamps can be kept at work for five hours, each lamp giving 10 candles. There is thus 100 candle power for five hours.

A Comparison of the Measurement of the Electric Light and Gas.

To the Editor of the Times:

Sir,—Referring to two communications lately appearing in the *Times* on the question of the method of charge for electric lighting—one from Mr. Arnold White, of the Edison Company, and the other from Mr. Mackenzie, an exponent of another species of electrical distribution—will you kindly allow me a few words? The essence of the question seems to be—What method of charge will best develop and insure to the users of the electric light the benefits of economic improvements?

The question resolves itself into two heads. First, whether the development of the burners be the best promoted by a method of charge which interests the undertakers in its economy, or by that which, as in the gas system, enlists them on the side of its wastefulness. In the first case, the development of the burners would yield to the undertakers an increased profit, while in the latter case it would reduce the profit. In the one case the price is reduced by virtue of the higher producing power of a certain investment and by greater consumption; in the other, only by reason of the greater consumption. The theory of the Parliamentary Bill that the development of the burner will be best effected by leaving it to the general public rather than to those more vitally interested would seem to be sufficiently contravened by the history of the gas burner, the development of which has only become active with the introduction of the incandescent lamp, thus proving that the public have left its improvement to the gas undertakers, and they now only take it up in self defence. I maintain, therefore, that the improvement of the electric burner will be more rapid in the hands of undertakers whose dividends depend upon it than if left to the general public, which can only reap a benefit in its individual capacity. The argument that the public does not benefit by the increased dividends of the undertakers does not avail against my proposition, since legal limitation and competition as between electric light companies and the gas companies will compel the undertakers to divide with the public by a gradual reduction of the price.

Secondly, whether best check is had upon the undertakers by a system of charging for that which is actually bargained for—*i. e.*, light, or by a system which, like the gas system, sells to the consumer, something from which he may in his own way produce light. In the one case he has only to measure the final product. In the other he has a more or less reliable record of the number of units of energy from which he has obtained an unknown quantity of light.

But Mr. Mackenzie asks, "How can we measure it?"

The plan is a simple one. The lamps provided by the undertakers are rated at so many candles each. Their consumption of energy is definitely known and fixed with a current of a given strength.

Thus, in the Edison system the standard lamp is of 16-candle power. This lamp requires three-quarters of an ampere of current to yield 16 candles of light per hour. The bill to the consumer is based upon these known standards. If the consumer has reason to question the accuracy of his bill he has only to count the number of lamps in use for a given number of hours, multiply the two together, and the total by 16 (the standard of the lamp) and he will have an absolute check.

For illustration, the undertakers present a bill for 48,000 candles of light. The consumer counts his lamps and takes note of the number of hours they burn, and finds that he has ten lamps burning ten hours per day, or one lamp for 100 hours. This for thirty days gives him 3,000 lamp hours. This, multiplied by the company's own standard of 16 candles, yields 48,000 candles, and he has proof positive that the bill is correct. If the bill were more, he has proof of its error, which the undertakers would be bound to accept, since no matter what number of amperes of current the meter may have shown to have passed, the calculation of the amount of light supplied is made from the basis of so much current per lamp to produce 16 candles of light per hour. If the undertakers object to the consumer's count, they can make it themselves or in other ways test the accuracy of their meters.

Compare this with the check upon a gas meter. The bill is for 2,400 feet of gas. An examination of the meter shows the record to be in accord, but does that prove that the consumer has had 48,000 candles of light? No; the larger proportion of his gas may be escaping and not supplying light at all. Or, if not escaping, his burners may be so wasteful that instead of getting 16 candles from a 6-foot burner, he may, as we all know, be only getting 8 or 10.

Why then perpetuate a crude and imperfect system offering no real check when a perfect and absolute one is available? The candle power of the lamps may be tested in many ways, but this, like many other details, takes care of itself where the undertakers are interested in their efficiency. If the lamps were under candle power it would be because an insufficient current was passing through them. This would show upon the meter; and the bill would be proportionately decreased—a matter which the undertakers would speedily remedy in their own interests. If they were above their proper standard, thus giving the consumer more light than he desired to pay for, the lamps would be more quickly destroyed, and since the Edison system contemplates the supply of lamps free of charge to the consumers, it would speedily remedy this defect to save itself a heavy charge for lamp breakages.

In respect to the observations of Mr. Mackenzie as to the difficulties consequent upon a system of direct supply and of the utility of a method involving the intervention of some apparatus or storage device between the lamps and the generating source, I wish only to remark that Mr. Edison has fully overcome all the difficulties, as is proven by the fact that he is now supplying 400 customers from one station, the current ramifying through a network of over 24 miles of underground wires, and over 100 miles of house wires, without the loss of sufficient current on the whole system to keep alight a single lamp, and that this current has been maintained without a moment's interruption since the 4th day of September last, varying in quantity, of course, directly proportioned to the number of lamps alight at one time; and, further, that since any other than a direct distribution means a re-distribution, and re-distribution means more or less loss or waste of energy, it follows that the direct system is the economical one, therefore the one best able to give cheap light. The important item of the cost of conductors involved in a system of direct supply has been solved in another way than that which Mr. Mackenzie's and similar devices provide—the problem of a reduction of their cost having been attacked and overcome without interference with the simplicity, reliability, or energy and economy of the system.

Very respectfully and obediently yours,
EDWARD H. JOHNSON,
Vice-President Edison Electric Light Company, New York.
Royal Hotel, London, April 3, 1883.

Observations on the Figures of the Consumption of Zinc Given by M. Trouve for His Bichromate Batteries.

By M. E. Reynier.

The communication presented to the Academy at its last meeting by M. Trouvé seems to offer a contradiction which it is necessary to point out. The table of experiments shows a consumption of 456 grms. zinc in five hours for twelve elements or 7.6 grm. hourly per element. In this experiment the intensity of the electric current was 12.6

amperes at the outset, falling gradually to 6 3 amperes, or an average of 9.45 amperes. But a current of this intensity requires theoretically the consumption of 11 34 grm. of zinc hourly per element. It is always possible that the actual result may fall short of theory, but here we have a considerable excess. It is therefore to be desired that M. Trouvé would carefully repeat his experiments, so as to obtain more probably figures. Perhaps he may be led to modify the conclusion which he has believed it possible to draw in his former memoir.

Ball's Unipolar Machine.

Editor Electrical Review:

A good invention will survive all adverse comments thereon, and, were it not for several extraordinary misrepresentations in reference to my unipolar dynamo electric machine, I would have allowed all criticism to pass unnoticed.

Objections have been made to the use of the name "unipolar," but not a single sensible reason has been given, why it should not be used. My fundamental invention consists in the employment of an armature in connection with one pole of a magnet, but I find it an advantage to utilize both poles of a magnet and therefore employ two armatures, one with each pole. The two poles can be on opposite sides or on the same side of the armatures.

It seems to me that it is far more appropriate to apply the said name to my machine than to that of Siemens and Halske, in which two copper cylinders are employed in connection with two magnets, each cylinder revolving between two poles (one of each magnet) of opposite polarity,

I am after results, and care nothing for names, and if any one can suggest a more appropriate name for my machine I will be pleased to adopt it.

None of my machines have been placed on the market in this country, and only a limited number of machines of the first pattern have been made in Canada. Having the cooperation of capitalists, who appreciate the importance of a first-class and complete system of electric lighting and motive power, there has been no necessity for placing an incomplete system on the market in this country.

The criticism of the *Elec'rical World* on my machine is simply misrepresentation and theoretical bosh, as I can practically demonstrate. That the expert of the said paper is a mere theorist and book electrician, is quite evident from his articles on electric lighting, which contain nothing new, being nothing more than a rehash from other writings, and which I can say from experience will strand any inventor or electrical student, if closely followed. I owe my success to the fact that I have ignored the old theories, in reference to the action of the ring armature and lines of force.

Adverse criticisms upon my machine have, naturally, been expected, for the reason that nearly every electrical writer has become so thoroughly imbued with the old theories, in reference to the action of the ring armature, that it is difficult for them to quickly comprehend a new discovery thereof. They have erroneously been governed by one of Faraday's experiments, made in 1831, in which he employed a rotating copper disk between the two poles of a magnet, and found that when it rotated nearer one pole than the other that the effects obtained were by no means so powerful as when it rotated equidistant between the two poles. (Faraday's Experimental Researches, §97.)

In one of my first experiments, similar to that of Faraday, I found that just the opposite effect was produced in a ring armature, and also that the best effect was produced when one pole was altogether discarded, thereby demonstrating that there is a great difference between the copper disc used by Faraday and the armature of the present day.

Furthermore, I am prepared to demonstrate the importance of my unipolar discovery by making a competitive test with any bipolar or multipolar electric generator in the market.

The New York *Electrician* in referring to my machine says:

"The arrangement shown also involves mechanical difficulties which must prove very serious. It will be observed that by presenting only one pole of the field magnet to each armature, the armature is powerfully attracted toward the pole, and the whole strain of this attraction is brought to bear transversely upon the armature shaft."

The fact that not the least detrimental effect has been experienced with the armature shafts of any of the machines which have been in constant use in Canada for over two years, is sufficient evidence that the above opinion is of no account.

The following mistatement by the same journal—"Some of the machines with the ordinary bipolar field and a single armature, which are now in common use, show a net efficiency of over 90 per cent."—also needs correction.

The mean net efficiency (the proportion of power accounted for in the lamps or external circuit) of the four best high tension machines (Burgin, Gramme, Siemens and Weston) at the late Paris Exhibition is 65.8 per cent.

The net efficiency of my unipolar machine of the first pattern, as tested in England, is 69 per cent., being the highest of all high-tension machines, while my latest improved machine will show a higher net efficiency. It is said that Edison claims a net efficiency of 85 per cent. for his low-tension machine. It must, however, be borne in mind that it is only used for incandescent lighting, and that it is easier to obtain a higher efficiency in a low-tension machine than in one adapted for arc lighting.

The armature of the machine now in London is only 8″ in diameter, and consequently it has been run at a high speed. The revolutions of an armature can be lessened to any desired number by increasing the diameter thereof.

The periphery speed and not the revolution of an armature must be considered.

Mr. Rankin Kennedy in a communication to the *London Electrical Review* of the 7th ult. says:

"That it can hardly be claimed as a discovery at this time in electrical advance, that one pole of a magnet can generate currents in a rotating Gramme bobbin."

Other writers have also endeavored to claim that I have made no discovery by citing the experiment made by Faraday in which he employed a copper disc rotated nearer one pole than another, and also to the experiment in which he fastened the copper disc to one pole of a rotating permanent magnet. In both experiments very weak currents were, however, generated.

It is quite evident that Mr. Kennedy and all other inventors have been ignorant of the fact that the best results are obtained in a ring armature when it is subjected to only one pole of a magnet.

The electric generator devised by Mr. Kennedy in which he employs a ring armature with four pole-pieces as shown in the *London Electrical Review* of March 10, 1883, fully confirms his ignorance of the said fact, as it the is most unscientific machine thus far invented.

Mr. Kennedy and also the expert of the *Operator and World* still further show their complete ignorance of the subject, the former by suggesting a ring armature in connection with two like poles, which he terms the true unipolar machine, and the latter by citing as an anticipation of my invention, the carbon regulating mechanism of the arc lamp devised by M. Tchikoleff, a Russian, in 1874, which consists of a ring armature employed as a motor in connection with two pole-pieces of like polarity, the magnets of which being in two parallel circuits

It is quite evident that if the said lamp regulating mechanism had suggested the advantages of employing an armature with but one pole, that all inventors would not have been working in ignorance of the said advantages since 1874 by constructing bipolar and multipolar generators.

I tried the experiment of an armature with two like poles about four years ago and discarded the arrangement on account of the unsatisfactory results given.

I will add that it is the opinion of prominent patent experts who have thoroughly examined the matter that there is novelty in my invention, and that the broad claim of an armature with one pole of a magnet allowed me by the Patent Office is valid.

C. E. Ball.

New York, May 14, 1883.

Triumphant Over All Obstacles.

THE ELECTRIC LIGHT FORCES ITS WAY INTO THE STAID CONNECTICUT CAPITAL — THE PAST, THE PRESENT AND THE FUTURE.

Hartford, Conn., May 8, 1883.

The unexpected boom that has been given to electric lighting in this city within the last few weeks is attributable to three causes: A long delay since a company was first organized, and through the press and otherwise made very big promises which amounted to naught; a growing feeling of mortification that Connecticut's sole capital should be behind her sister cities of smaller size and less importance in availing herself of this great illuminant, and a general dissatisfaction with the gas furnished by the local company for both public and private lighting purposes. As regards the latter reason the Mayor voiced the public sentiment in his last message in which he declared that the lighting of the streets of the city has not been satisfactory in any respect.

At any rate, we have got the electric light now, and it has come to stay. It is no longer an experiment even here, for its practical value is fully established, and our merchants are calling for the lamps faster than the company can put them in.

The American Electric and Illuminating Company of Boston have just completed their contract for the first 100 lights ordered, and have contracted for a plant of 100 more to be put in by the latter part of August, or earlier, if possible. It is only four weeks since the company put up their first light, and the extraordinary advance they have made has been in spite of the strongest opposition. But perhaps a brief retrospect here would be in order.

The present company was chartered in 1881, but after they got their charter we heard nothing more of them until 1882, when they came up again asking for more privileges. Inquiries of the officers were replied to, in substance, that they were in no particular hurry, but were waiting for some good system to be perfected. Connecticut like, they were willing to let other cities do the experimenting, and they would reap the benefits of that experience.

It was the opinion of some of the stockholders, too, that simply an arc system would never pay here, and that it was best to wait until some cheap incandescent light should be devised; but it was coming, oh yes, it was coming; be patient for a few weeks. Meanwhile the gas company people were laughing in their sleeves. But last fall rumors of a rival company began to take definite shape. Then the stockholders woke up. A meeting was called, considerable capital stock paid in, the following officers elected: Mr. A. C. Dunham, President; Mr. H. M. French, Vice-President; Mr. Howard M. Clark, Treasurer; Mr. S. C. Dunham, Secretary; Mr. G. B. Hubbell, Superintendent, and before the people were fully aware of it a building for the dynamos was up.

The American Company were so thoroughly convinced that the investment was a paying one that they took out in stock most of the expense of putting in the first plant, and are well represented in the management of the company.

The plant is in every way fully up to the manner in which our people usually do things, consisting of four dynamos with a capacity to feed fifty lamps each, run by two beautiful 50 horse power Armington & Sims engines made expressly for this purpose.

The company made a bold strike in the first place by putting in twenty lamps at the Union depot, where everybody would be most likely to see the light and judge of its merits. Of course the gas company fought this home-shot tooth and nail. They even offered to light the depot for *nothing* if the electric lamps were kept out. But up they went, and the public came, saw and were conquered. The company have succeeded even beyond their expectation. The leading merchants actually demand the light. The prices here are lower, I believe, than in other cities—75 cents a single lamp per night, and 60 cents for two or more; and this is done at a fair profit.

The principal obstacle so far has been in laying the wires. The street commissioners don't want to give permission to put up poles in the streets. Thus far the wires have been carried over private houses by arrangements with individuals, but the consent of most of them was hard to get, and then only on condition that the wires should remain but temporarily. But the company have submitted a proposition to assume the responsibility of lighting the streets, which, if accepted, will of course carry with it permission to put up poles. They offer to replace 400 gas lamps with 100 electric lamps, and to illuminate the outlying streets with improved naphtha lamps. This will do for a starter, and moreover they agree to furnish this light every night in the week, every week in the year for $8,000 less annually than the city is now paying, and the streets will be *lighted*. This offer is still under consideration, and the city council are expected to act upon it next week. It is rather awkward for the electric light company that one of the most influential members of the board of aldermen is treasurer of the gas company, and is the life and soul of it. The contest (for there will sure to be one) will be watched with interest; but consent has got to come, eventually, for there is a strong public sentiment back of it. Singularly enough support comes from an unusually strong and aristocratic quarter—the Hill—and for a purely selfish reason. The young people out there are particularly devoted to lawn-tennis and croquet parties, largely gotten up by the Trinity College students, and friendly tournaments are arranged. To hold these early in the afternoon is very inconvenient, and if left till too late the pall of night shuts down on an unfinished game. Hence the electric light company have received orders to illuminate a few of the best kept lawns, but—for obvious reasons they can't get out there without the poles.

Of course, another very important consideration in this insurance center was the matter of insurance risk. But after a little investigation that has been amicably arranged by adopting the policy of the New York underwriters.

As before remarked, after a long struggle the electric light in Hartford has become a fixed fact. We are to be congratulated. As our popular little governor once lifted himself into notoriety by exclaiming: "You can't fight the nineteenth century!"

An Electric Railway Company.

The certificate of incorporation of the Electric Railway Company of the United States was filed in the County Clerk's office on the 7th inst. The corporators of the new company are Grosvenor P. Lowrey, Sherburne B. Eaton, Robert M. Gallaway, Thomas A. Edison, Simeon G. Reed, Robert E. Deyo, Stephen D. Field, Charles W. Rogers, John P. Kennedy, and George S. Scott, who, with the exception of Thomas A. Edison, are also its Trustees for the first year. The objects of the company are stated to be "the acquisition, development, use, and disposition of devices, inventions, improvements, caveats, applications for patents, patents, grants, concessions, or privileges for electric propulsion, or the use of electrical apparatus on railways, or applicable in any way to the use of electricity or electrical apratus in any form for constructing, equipping, operating, or maintaining railways, or for railway appliances," &c. Its capital stock is fixed at $2,000,000, divided into 2,000 shares of $100 each. The company is to carry on its business in Canada as well as in the United States. At a meeting held on Tuesday last the incorporators were elected

directors of the new company, and the following officers were chosen: President, S. G. Reed of Portland, Oregon; Vice-President, C. W. Rogers; Secretary and Treasurer, Charles Dimon, and Stephen D. Field, Electrician. It is understood that Mr. Reed represents the interest in the new enterprise of President Henry Villard of the Northern Pacific Railroad, and that other directors represent other large capitalists, among them Cyrus W. Field. Mr. Rogers, the Vice-President, has been the active man in effecting this consolidation of the Edison and Field interests in electric motors. The company controls all the patents of each, and its business will be the development and building of electric motors for railway use.

GENERAL COMMITTEE ON UNDERGROUND COMMUNICATION,
115 Broadway, Room 47,
NEW YORK, May 7, 1883.

At a meeting of the General Committee on Underground Electrical Communication, held May 7 at Room 47, 115 Broadway, the following sub-committees were appointed:

Sub-committee on Electrical and Mechanical Devices—Albert B. Chandler, Joseph P. Davis, Frederick H. May, Henry Morton, Henry W. Pope, Garret S. Mott, Elihu Thomson, J. Eliot Smith.

Instructed as follows: It shall be the duty of the Committee on Electrical and Mechanical Devices to examine inventions now in use, or that may be presented to it; to give notice to inventors as to the nature and extent of the requirements, and state the problem to be solved, with the purpose of concentrating inventive effort in a practical direction; and generally to consider and report, for the instruction of the General Committee, the state of the art, and that the difficulties are or are not surmounted, or, in the judgment of the committee, surmountable; and in default of an ideal and perfected system, to make such recommendations to the General Committee as may in its estimation seem worthy of adoption, as a partial or temporary remedy through the difficulties encountered, pending the invention and perfecting of a completely satisfactory system; to report in the first instance to the Committee on Business.

Sub-committee on Law and Franchises—Leonard E. Curtis, Sherburne B. Eaton, William M. Ivins.

Instructed as follows: It shall be the duty of the Committee on Law and Franchises to examine the laws and franchises granted by the State and city, and the general legislation, favorable and unfavorable, bearing upon that subject; to determine whether any further powers are required, and if so, what, in order to carry out the plan of underground electric communication in the interest of all the electrical corporations, as approved by the Committee on Electrical and Mechanical Devices, and whether or not any general law on the subject is desirable; and, further, in the event that the Committee on Inventions adopt any system, invention, or device, which is the subject of a patent of the United States, to examine or cause to be examined the validity of the same, and its scope and sufficiency; to report in the first instance to the Committee on Business.

Sub-committee on Business Organization—Colonel Thomas J. Montgomery, Augustus C. Richards, Clark B. Hotchkiss, Charles R. Flint, Rowland R. Hazard.

Instructed as follows: It shall be the duty of the Committee on Business Organization, if it shall appear from the conclusions of the two other committees that a system is devised, or can be formed out of existing material, and that the required laws and franchises exist, to frame for the consideration of the General Committee a plan of organization for carrying into effect the recommendations of the other committees, which shall include the formation of an independent company for that purpose, if that is deemed the better way, with the necessary by-laws for the same, and a system of control in the interest of the contributing corporations; it being understood that upon the completion of the work of the Committee on Business Organization the General Committee shall be called together to act upon the reports of the three committees.

The Conductivity of Carbon.

A contribution to the theory of the carbon telephone transmitter is to be found in the recent researches of Mr. J. Probert and Mr. Alfred W. Soward. It has long been known that carbon has the power of absorbing and condensing gas within its pores, and also that the resistance of carbon powder to the passage of an electric current through its mass is not a true resistance, but may be resolved into two factors—the true resistance of the carbon particles, and a resistance or disturbance due to the presence of gas in the spaces. In blocks of solid carbon the air spaces are smaller, and this disturbing influence is weaker than in the case of carbon powder, but it exists; and the experiments of Messrs. Probert and Soward prove that the elastic conductivity of porous carbon in different gases at different pressures varies with the chemical nature and density of the absorbed gas.

On the Composite Character of the Induction Spark.

BY COUNT DU MONCEL.

(*Translated for the* ELECTRICAL REVIEW *from La Lumière Electrique.*)

(CONTINUED.)

In our former article we have shown that when the resistance of the gaseous medium traversed by the induction spark was diminished, either by a vacuum or by the concentration of the calorific effect of the spark, the aureola was developed in a remarkable manner, and gave rise to luminous effluvia of a very beautiful appearance. One can develop this aureola by other means, for instance, by heating the space between the two electrodes; or better, by making the spark pass through a smoky flame, even the flame of an ordinary candle will do. The spark then not only traverses a much greater space, but the aureola attains such a great development and such a degree of splendor, thereby diminishing the lines of fire of the direct discharge that one can scarcely distinguish the latter, which then appear of a bluish tint. At the same time the galvanometer indicates a large increase in the strength of the current. Besides, the conducting power of the heated gases is such that a discharge passing in the vicinity of a candle flame bends so as to pass through the flame, notwithstanding the fact that its path is then longer.

In certain conditions it happens that the whitish aureola of the spark passing through a sooty flame becomes furrowed by slightly darkened vertical striæ, which resemble the stratified light of the induction spark in vacuo, but it is necessary, in order to perceive them, that the spark be produced in the dark portion of the flame, and near to the wick.

It is easy to demonstrate besides that it is chiefly to the heating of the air that the aureola owes its formation, for if we arrange it so that the spark cannot develop a great heat at the electrodes, we obtain only threads of fire without the luminous aureola.

On the other hand, if we use electrodes capable of developing a great heat, as for example, pieces of carbon, the aureola attains a considerable development, assumes a red color, and the scintillating points between which the lines of fire are exchanged become so brilliant at the negative pole that they produce a radiant light analogous in splendor and appearance to that of an electric arc lamp. The galvanometer then indicates that the current is stronger than when metallic electrodes are employed, and if we employ only one piece of carbon the current is stronger when the carbon is placed at the negative electrode than when it is placed at the positive, because with the induced currents of the Ruhmkorff coil the greatest heat is produced at the negative pole.

An effect of the same kind is produced with metallic electrodes, composed of different metals more or less fusible or volatite. These develop with the spark which they produce, according to Mr. Poggendorff, a greater or lesser quantity of heat, in proportion to the greater or lesser facility with which, under the calorific effect of the current, their particles are disintegrated. Then if the negative pole where the heat is greatest is composed of the most volatile metal the transporation of metallic particles is greatest, and at the same time the heat which is communicated to the latter is most intense, two causes which should increase the conductivity of the interposed medium. The transmission of the current must of necessity be affected by these conditions, and its strength should vary not only with the kind of metal used for the electrodes, but also with its direction in respect to the electrode which is composed of the most volatile metal. This effect is so marked that, according to the experiments of Mr. Poggendorff, a platinum negative electrode and a bismuth positive electrode having given in one minute a temperature of * 18.5° C were able to furnish, by simply reversing their polar direction, an elevation of † 30° C. in the same length of time.

The following list shows, according to Mr. Poggendorff, the order in which the metals should be ranged with respect to their calorific properties in the experiments just mentioned:

Platinum, copper, iron, silver, lead, tin, antimony, zinc, bismuth; platinum being considered as giving a spark endowed with the least calorific power, and bismuth as giving a spark possessing the greatest.

It is not necessary to attribute to heat solely the formation of the aureola of the induction spark. The introduction of a body possessing a secondary conductivity, such as the vapor of water, powdered carbon, etc., into the medium traversed by the discharge, exercise a great influence; but there is another cause which we have not yet considered, and which plays, we believe, a much more important part, for we may consider it to be the initial cause. These are the mechanical reactions of the electricity at the disjointed extremities of the circuit. It is not, in fact, the polar calorific action exerted on the medium interposed in the solution of continuity where the spark is produced, which precedes the appearance of the spark, and prepares the way for its coming. We can easily convince ourselves of that fact by placing a thermometer between the two electrodes of the circuit before the spark passes. This instrument will indicate no elevation of temperature. But if we consider that the mechanical effect of the fluids which spread away in tufts from the two sides of the solution of continuity before the discharge is sufficient to repulse in all directions, like the action of a bellows, the light particles of matter which the tufts encounter in their movement, we can easily comprehend that this action, showing itself at first on the gaseous particles of the interposed medium, must have for result a rarefaction of this aëriform medium and a radiant molecular movement, taking place principally in the direction of the discharge. But these two effects ought to contribute powerfully to the transmission of the electric fluid; for, on one hand, the resistance opposed to it is diminished by the rarefaction of the air, and, on the other hand, the conductivity of the gaseous medium is augmented by the mechanical transportation of the electrified particles of which it is composed. This transportation, coming to the aid of the movement of the electric fluids themselves, constitute a sort of mechanical conductivity, which must of necessity have an effect in the phenomena produced by the induction spark. One can easily estimate the value of this mechanical effect of the discharge on the particles of a gaseous medium interposed in that discharge, either by means of a Kinnersley thermometer, or by passing the discharge through the flame of a candle, or by means of the experiment described in the number of *La Lumière Electrique* for September 30, 1882, on page 331; but the following is an experiment which can scarcely leave a doubt on the important part which the polar repulsions of the induced current play in the development of the aureola of the induction spark.

If we take a little tube of about four centimeters* long and of one centimeter† diameter, whose ends are hermetically sealed, and fasten to the middle portion of this tube another tube of 25 or 30 centimeters long, in such a way that the interiors of the two tubes are in communication one with the other, and then place the two electrodes from which the discharge passes in the little tube, so that the discharge shall pass opposite the orifice of the long tube, whose free end is also hermetically closed, it will happen that the aureola of the spark will be projected in the shape of a dart towards the orifice of the long tube. In this case no exterior reaction is in operation; there is neither projection of the air nor magnetic repulsion, yet the aureola behaves just as though an effect of this nature existed. Then such an effect can only proceed, under such conditions, from polar electrical repulsion, which, driving the gaseous molecules into the long tube, produce a current of air which carries the aureola with it. It is, without doubt, to an analogous effect that the aureola owes the considerable swelling out of its middle portion.

I have stated elsewhere that the aureola is less developed in proportion as the pressure exerted on the medium in which it is produced is stronger, and the medium is drier.

According to the results of these different experiments, we may conclude—1st, that it is *to the dilatation of the air of the interval traversed by the spark, to the heating, and to the introduction in that air of certain bodies endowed with a secondary conductivity, such as the vapor of water, metallic or carbonized powders—in a word, to the relative conductivity of the medium interposed across the discharge,* that we must attribute, in great measure, the formation, and especially the development, of the aureola of the induction spark; 2d, that, as the conductivity of this medium interposed in the discharge is increased, the greater will be the tendency of the lines of fire of the direct discharge to be compounded with the aureola which surrounds them.

It follows from this that, if we vary the conditions of the conductivity of the medium traversed by the spark, or the power of the physical agents intended to produce this conductivity, we should be able to cause one or the other of these two manifestations of the discharge (the aureola and the lines of fire) to predominate. Therefore, if we suitably diminish or increase the strength of the induced current; if we lengthen or shorten the spark sufficiently, we ought to succeed in making one or the other of the two manifestations disappear. Experiment demonstrates this to be the fact, but in order that the discharge which remains shall still preserve its characteristics, the strength of the current must not be too great.

Insufflation, or any current of air whatever, by reacting on the gaseous medium traversed by the induction spark, has for effect to displace its aureola and to project it in the form of a luminous sheet, most frequently of an irregular shape, whose color varies according to the energy of the current of air. This mechanical action does not seem to sensibly affect the jets of fire of the direct discharge, at least when the spark is not too long.

If the current of air be feeble and its direction be perpendicular to the discharge, the projected sheet of light of the aureola, resembles an agitated flame rather than an electric discharge; it is not homogeneous throughout its whole extent, and one can readily recognize that the current of air produces on it irregularly shaped furrows of a duller glow. When the current of air is more energetic, numerous brilliant zig-zag threads, generally parallel one with another, are displayed in the midst of the luminous sheet, which then seems circumscribed by two bundles of violet threads, which start from the extremities of the electrodes and rejoin each other by irregular curves. The aureola is then completely separated from the lines of light. Finally, with a still more energetic current of air, the sheet of light

* 18.5° C. = 33.3° Fahrenheit.—TRANSLATOR.

† 30° C. = 54° Fahrenheit.—TRANSLATOR.

*4 centimeters = about 1 6.10 inches.—TRANSLATOR.

† 1 centimeter = .39371 inches.—TRANSLATOR.

disappears and the luminous zig-zag threads which are then more rare and further apart from each other, subsist alone in the middle of the space occupied by the sheet; sometimes even the discharge may be completely arrested. Whatever may be the manner in which these effects show themselves, the mechanical action produced by the current of air, is always accompanied by a noise which resembles the rippling produced by a similar current of air acting on a liquid. When the current of air is directed parallel to the discharge, the latter can take place at a greater distance, and the aureola so blown upon can then be projected on an electrode in the axis of the current of air. Then the electric discharge, which traverses it, acquires such a degree of persistence, that if, by means of a second conductor connected as a branch from one electrode, we attract the jet of fire forming the direct discharge, we obtain the complete separation of the two manifestations of the spark. It suffices for this effect to be produced, that the forks of the branched electrode shall be of unequal lengths, the intensity discharge will pass from the shortest and the quantity discharge or aureola will be hung out like a flag from the longest, both joining together on the opposite electrode. This experiment, due to Mr. Perrot, and which is only a modification of mine, has the advantage that it permits of forming with the branched conductor two independent circuits, by means of which we can study the individual properties of each of the two manifestations of the spark, especially from an electro-chemical point of view, as we shall see later.

Currents of air are not the sole means at our command for producing this displacement of the aureola of the induction spark; any mechanical or physical cause having for its effect the modification of the medium in the vicinity of the discharge and the production of a movement therein, can produce this result. We shall soon see a proof of this; but there is a curious effect of which we should speak now, because it belongs to the same order of facts as those which we have just been studying. It is that if we make the spark pass between two veins of liquid moving at a great speed, the aureola is dragged along in the same direction as the liquid molecules, whilst the luminous lines of the direct discharge are not at all influenced by this movement. This experiment, devised by Mr. Perrot, has been modified in a rather curious manner by Mr. de Romilly.

Insufflation by the bellows demonstrates very clearly the influence of the vapor of water in the secondary conductivity which it can give to the current which traverses the aureola. Thus, if by directing a powerful current of air from the bellows on this spark, we reduce the projected aureola to a few luminous threads folded in zig-zags and with wide spaces between them, it will be sufficient to place a small piece of ice in the vicinity of these lines of fire, when the red color of the aureola immediately reappears and the aureola is developed.

If we interpose a galvanometer in the wire carrying the discharge on which the current of air is directed, we see that the insufflation produces a notable enfeeblement of the induced current, an enfeeblement which is more marked in proportion as the insufflation is more energetic, the length of the spark shorter and the current relatively less strong. With a moderate insufflation directed perpendicularly to the discharge, a current marking 40° suddenly falls to 15°, and another marking 60° falls to 30°. With an insufflation made parallel to and in the direction of the discharge the enfeeblement of the current is less marked. Thus a current whose strength was represented by 40° only fell to 30°. The explanation of these effects is very simple, because the insufflation projects the aureola in the form of a thin and extended sheet of fire, thereby diminishing the conductivity of the gaseous conductor, either in consequence of the cooling of the conductor by the rapid and continual renewal of the gaseous masses of which it is composed, or by the diminution of the section of the conductor itself. With the insufflation directed parallel to the discharge, the first of these causes acts probably less energetically than with the insufflation perpendicular to the line of discharge, because the air which passes over one of the electrodes is relatively warmer; but what causes the greatest portion of the difference is that the enfeeblement of the conductivity of the gaseous medium produced then by the insufflation is partly compensated for by the mechanical conductivity which is then very much aided, and which enables the discharge to take place from a greater distance.

If insufflation diminishes the strenght of the current traversing the aureola of the induction spark, it can on the other hand, under certain circumstances, augment the importance of the jet of fire of the direct discharge by preventing it from passing, to a great extent, through the aureola. We have seen, in fact, that when the electrodes are terminated in carbon points the jet of fire is so much reduced by the great conductivity of the aureola which surrounds it that it is scarcely possible to distinguish it in the midst of the aureola; but if we blow on the spark the conductivity of the medium interposed in the discharge is lessened, the jet of fire of the discharge is augmented in size and importance, and the aureola even loses its red color and assumes its characteristic violet hue.

We can also separate the two manifestations of the induction spark by favoring the flow of the tension electricity which gives rise to the lines of fire of the direct discharge. Thus, by curving at right angles the extremities of the electrodes, which should then be chosen of a smaller diameter and pointed at the ends, we can, by dipping the lower surface of one in a liquid and holding the other at two millimeters'* distance above the surface of the liquid, cause the tension discharge to take place between the two points of the electrodes, and the aureola will pass directly between the liquid surface and the curved portion of the electrode placed above it. We shall return later to this experiment; we mention it here because it constitutes one of the means of separating the aureola from the lines of fire of the direct discharge. Again, magnetic actions are, as we have seen in our articles published in Vol I., page 43, and Vol. VI., page 428, a very energetic means of separating the two forms, of which one, the aureola, projects itself under the form of regular circular sheets, which projects above or below the magnetic poles, resting on them on the left or the right, or developing in an heliçoidal surface, of which the direction of curvature varies according to the direction of the current, or the position of the magnetic poles, and according to whether the discharge is made in the axial or equatorial lines of the magnet. We have seen that these effects were the result of reactions of currents on currents exchanged between the magnetic current which is fixed, and the electric current which, being carried by a flexible conductor, forces the latter to lend itself to the reactions which are exerted on it according to the laws of Ampère. The most curious of these effects is the projection of the aureola in the form of a helix, which is manifested when the discharge takes place on the axial line uniting the two poles. The direction of the contour of this helix varies, as we have just said, according to the direction of the current or that of the magnetic poles, but in order that the experiment may be clear and distinct, it is necessary that the two electrodes should not be so arranged that one is exactly a prolongation of the other, in order that there shall be a determinate effect. I have fully described these effects in my notice of the Ruhmkorff apparatus, and in the articles of which I have already spoken, and I have shown that they give rise to very curious stratified luminous effects when the spark was passed between two carbons (see Vol. I., page 43). I shall not, therefore, return to this question here; but I will complete what I have said by giving some figures which show the influence of this sort of insufflation on the strength of induced currents. By placing a not very sensitive galvanometer in the induced circuit I have obtained the following results:

Strength of current without insufflation.	60°
Strength of current with insufflation by currents of air	30°
Strength of current with insufflation by the electro-magnet, the discharge passing by the equatorial line, and the aureola being projected below the polar surfaces	40°
Strength of current, the aureola being projected above	50°
Strength of current, the discharge passing by the axial line, in either direction	54°
Strength of current, the discharge passing to one of the poles, the aureola being repelled toward the equatorial line	57°
Strength of current, the aureola being repelled toward the center of this pole	60°

If we combined together the insufflation by currents of air with the magnetic repulsion, the enfeeblement of the induced current is still more marked, and, naturally, this weakening is augmented when the electrodes are formed of carbon, because then the aureola is much amplified. The strength then falls from 62° to 35°, when it only falls from 60° to 40° with metallic electrodes. Moreover, one can distinguish this weakening of the current by the naked eye, by observing the points of the electrodes of carbon between which the spark passes. When the latter is not blown upon, the points redden promptly and are very quickly hollowed out, whilst, when the magnetic insufflation is produced, one perceives only traces of incandescence on the earbons, and the latter are consumed much more slowly.

In a coming article we shall study the peculiar properties of the two portions of the induction spark, the causes which can affect the tension discharge, and the spectroscopic characteristics of the two different forms.

TH. DU MONCEL.

[To be continued.]

* 2 millimeters = about .08 inch.—TRANSLATOR.

Coincidence of Heat and Electricity.

Based upon Becquerel's discovery that red-hot carbon plunged into nitrate of potash forms an electric battery, Dr. Brand, of La Rochelle, contrives an electro-generative torch or candle. The candle is prepared by making a paste of coal dust and molasses and moulding it into a stick, which serves as the inflammable wick of a candle. This rod is then covered with asbestos in a thin sheet, and dipped into fused nitrate of potash until a good thick coating of the nitrate adheres. The wick being ignited, it burns away, and a feeble current of electricity is drawn from the candle by the wires inserted into the nitrate and the wick.

The people of Los Angeles, California, are highly gratified with the successful lighting of their city by Brush lamps on masts. A leading gentleman of the city recently sent a photograph of one of the masts to a friend in the East and wrote as follows regarding it: "This mast is 155 feet high, with Brush arc lamps of 3,000 candle power each. The city is at present lighted with seven masts of this description. One other mast has been ordered. The city has an area of thirty-six square miles. The masts vary in distance from each other from one-half to two miles. The city has been lighted with gas for sixteen years, although the area being in the most thickly built portion of the city was small, and considered very inefficient. The present cost of illuminating the city is but a trifle more than that of the inefficient lighting by gas. All portions of the city now receive sufficient light for ordinary purposes *on the darkest nights*, and in the central portion of the city where gas was formerly used, the light is far more effective than gas ever was. The public are almost unanimous in its praise. Its efficiency in wet and stormy nights, especially when the sea fog drives in, is really wonderful. In a fog, when it is so dense that the lamps cannot be seen, the whole fog is suffused with the electric rays, rendering the streets perfectly light. It is now considered the finest lighted city on the Pacific Coast. With a view to more generally distributing the light several more masts are about to be added."

The *American Machinist* says that a marked feature of the machine business at the present time is the number of establishments, large and small, which are fitting up for the manufacture, as distinct from the building, of machinery. This tendency is not confined to any one branch, but is showing itself in machine tools, steam engines, machinery specialties and general machinery about equally. It is, after all, only in strict accordance with the principle which underlies all modern civilization, namely, the subdivision of labor, as applied not merely to labor alone, but to capital as well. Just as occupations have gone on, being divided and subdivided again and again, so in this country the time is approaching when builders of steam engines must prepare to meet the competition of manufacturers, except where special sizes or circumstances are concerned. In like manner even a small shop, fitted up with special tools adopted to the systematic manufacture of perhaps two or three sizes of a single machine tool, may have, so far as those sizes are concerned, a marked advantage over even the largest establishments prepared to build a multiplicity of tools in the old way, without specially devised facilities for the rapid and accurate manufacture of any. For many this may not be an agreeable prospect to face, but it is usually better to take a front view than a rear view of such a situation.

Dr. C. W. Siemens in the course of an address at the Institution of Civil Engineers on March 15, after describing the well-known experimental electrical railways of the Berlin and Paris Exhibitions, stated that an electrical railway six miles in length had just been completed in the North of Ireland. In this instance the two rails, three feet apart, were not insulated from the ground, but were joined electrically by means of copper staples and formed the return circuit, the current being conveyed to the car through a T-iron, placed upon short standards, and insulated by means of insulite caps. For the present the power was produced by a steam engine at Portrush, giving motion to a shunt-wound dynamo of 15,000 Watts, or 20-horse power. The working-speed of this line was restricted by the Board of Trade to 10 miles an hour, which was readily obtained, although the gradients of the line were decidedly unfavorable, including an incline of 2 miles in length at a gradient of 1 in 38. It was intended to extend the line 6 miles farther, in order to join another railway system. The electric system of propulsion was, in the lecturer's opinion, sufficiently advanced to assure practical success under suitable circumstances; such as for suburban tramways, elevated lines, and, above all, lines through tunnels.

The lecturer, however, did not advocate its prospective application in competition with the locomotive engine for main lines of railways.

Underground Telegraph Exhibition.

CHICAGO.—The Council's Fire-alarm Committee and other officials of Philadelphia, with a number of gentlemen from New York, Cleveland, and other cities, recently witnessed an exhibition of the conduit system of underground telegraphy given by the Chicago Sectional Electric Underground Conduit Co. Morse and telephone wires were placed in one mile and a quarter of the conduit, and signals were exchanged over the telephone wires without any perceptible interference in the way of induction from the Morse currents. The conduits are built of iron and contain copper wire shelves, over which insulated conductors are drawn by means of carriers worked from manholes at each street crossing. The new harmonic system was also laid in the conduit and was in operation during the exhibition without causing any interruption.

Telephonic.

Bridgeport Central Office.

The office and operating room of the Bridgeport exchange is undergoing a thorough reconstruction and renovating. The faithful and energetic manager, Mr. George E. Betts, after building up a large business, has turned his attention to the decorative art and will make some needed and substantial improvements in his cozy rooms. The switch-board will be enlarged by adding three new sections of the Western electric pattern to accommodate the increased business. New office furniture will be put in and such changes made as are essential to make it one of the model exchanges of the Southern New England System.

Colonel S. G. Lynch, of Chicago, well known in the telegraph and telephone field, has opened an office with Mr. Banta at that place for the purpose of dealing in telephone and electrical stocks. Their extensive and favorable acquaintance in the telephone field should assure them a large business.

We are pleased to note the arrival in this city of Señor Don Saturnino Yslas, member of the Royal Academy of Electricians and Engineers, and Superintendent of Telegraphs in Mexico. Señor Yslas is one of the most prominent and experienced electrical engineers in our sister republic, and much of the progress already made in electrical matters there is due to his energy and generous patronage.

At the meeting of the New York Electrical Society, Friday evening, May 4th, the subject of "Underground Wires" was discussed, after which Prof. P. H. Vanderweyde made some very interesing and instructing remarks on "Electro-Copper Plating," and exhibited some fine specimens of work done in a single cell of Daniell battery.

Dr. N. S Keith's lecture on "Electro-Metallurgy" was postponed until a future meeting, owing to the absence from the city of that gentleman, who was called away at the last moment.

In addition to his present duties as contract clerk, we are glad to note that Mr. H. P. Copeland of the Metropolitan Bell Telephone Company of this city, has been promoted to the position of purchasing agent.

The active co-operation of the telephone and electric light companies in endeavoring to devise some reliable system to place their wires underground is very commendable and will undoubtedly result successfully.

Taxing Telegraph Poles and Wires.

PHILADELPHIA.—The equity suits against the Western Union and Mutual Union Telegraph Companies and the City of Philadelphia, to restrain the companies from paying taxes, and the city from collecting them, on wires and poles, will be withdrawn from the United States Circuit Court. When the matter was called up before Judge Butler, it was announced that City Solicitor West had just entered suit in a State court raising the question as to the city's right to levy the tax. The Judge said that under the circumstances he would not take jurisdiction in the case.

Transfer of a Telegraph Franchise.

The stockholders of the Mutual District Telegraph Company held a meeting in Boston on the 8th inst. and voted to ratify the contract whereby all business, property and franchise of the District Telegraph Company of New York shall be transferred to the Mutual District Telegraph Company of Boston; also to increase their capital stock from $100,000 to $250,000.

Massachusetts Legislation in the Interest of the Telephone.

When the present charter of the American Bell Telephone Company was granted, a proviso was contained therein restricting the said telephone company from the acquisition of more than 30 per cent. of the capital of corporations operating under license from it, and of the capital of corporations in the State of Massachusetts, engaged in the manufacture of electrical instruments.

A bill has been introduced in the present legislature, authorizing the change or modification of the charter, by eliminating the foregoing clause. The bill passed both houses on May 8th, the House of Representatives passing it by a large majority.

The certificate of incorporation of the Molecular District Telephone and Telegraph Company was filed on Saturday last in the County Clerk's office. The lines of this company are to run from New York to Albany, Boston and intermediate towns and places in New York, Massachusetts, Rhode Island and Connecticut; also from this city across the North and East rivers and New York harbor to Jersey City, Long Island City, Brooklyn, Port Richmond, Staten Island, and through New Jersey to Philadelphia. The capital stock of the company is stated to be $700,000 divided into 28,000 shares of the par value of $25 each The officers of the company and the shares held by them are as follows: Braddock E. Strong, holding 5 shares; Joseph L. Houce, 10 shares; Jacob T. VanWyck, 5 shares; Courtlandt P. Dixon, jr., 13,990 shares, and John J. Waterbury, 13,990 shares. The company is to begin business to-day, and its existence is fixed for fifty years.

The certificate of incorporation of the Eastern Overland Telephone and Telegraph Company was filed in the County Clerk's office the 10th inst. The new company is to construct and maintain lines in this State, Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, and Maine. Its capital stock is $2,000,000, divided into 20,000 shares of $100 each, which are held by the corporators of the company as follows: John R. Bartlett, of New York City, 16,400 shares; Samuel W. Hale, of Keane, N. H., 200; John B. Reynolds, New York City, 200; Lucius V. Walkley, Plantsville, Conn., 200, and Benjamin Thompson, New York City, 3,000. The certificate of incorporation of the Rochester District Telegraph Company was also filed. This company is to carry on a general telegraph business in Rochester and to sell electrical apparatus all through the State. Its corporators and the holders of its 6,000 shares of stock are Gen. W. Blanchard, 2,000; S. L. Phillips, 2,000, and S. H. Sterns, 2,000. Its capital stock is $60,000, divided into 6,000 shares of the par value of $10 each.

Applied science has so revolutionized society and affairs that one queries what the end will be, for as yet we have barely more than skirted the edge of the possible, and the changes in store must be vastly greater than those already accomplished. It is but a few years since the first telephone or talking telegraph was invented, and to-day the improvements, aids and appliances that cluster around it are nearly innumerable, and from the, at first, quite short circuit instrument has been evolved the long distance telephone, of which several were recently successfully tested over the Postal Telegraph Company's wires in New York, from that city to Cleveland and Chicago. Among those used was the Globe instrument, the property of the Globe Telephone Company, organized for long distance work, with a capital of $10,000,000, its officers being Howard Payson Wildes, president, and Amos Rogers secretary. The company's offices are in the Mills Building, Broad street, New York.

It is reported that a proposition will be made by the telephone and telegraph company of which Logan H. Roots, of Little Rock, Ark., is president, to purchase the military lines running west from Denisons, taking in Jacksboro, Concho, Fort Davis and intermediate points, and the line bearing from Concho southeast to Mason, Fredericksburg and Boerne, terminating at San Antonio; also including the line from San Antonio to Eagle Pass, including Castroville, Brackett and Fort Clark. Several private parties will compete for the purchase of the new center lines, or part of them.

Work will soon be commenced to connect Marshall, Texas, with Jefferson, in the same State, and Shreveport, La., by telephone. The intimate business relations existing between the three cities is given as the prompting motive for the enterprise.

On the 13th of June the Association of Railroad Telegraph Superintendents meet at Chicago.

Telegraph Poles in Streets.

THE CHICAGO CITY COUNCIL GRANTS THE PRIVILEGE TO THE DISTRICT CO.

The City Council has passed the ordinance granting to the District Telegraph Company of Chicago the right to erect poles within the city for stringing telegraph wires placed in cables. Under the existing ordinance all the telegraph companies were to have been compelled on the 1st of the present month to place all their wires underground, but the operation of the law was delayed by an injunction granted by the courts. The present ordinance grants the privilege to the new company to erect iron poles at least eighteen and not to exceed thirty feet high, to be placed just inside the curb line, and in such streets, alleys and tunnels as may be designated by the Mayor and the Commissioner of Public Works. It provides that the poles shall be neatly painted. The city is to have the privilege of stringing its fire-alarm wires upon them without cost. The ordinance finally asserts that the privileges contained in the ordinance are granted temporarily to enable it to be demonstrated to the satisfaction of the Mayor and city authorities that the underground system of telegraphy is thoroughly practicable and advisable to be put in operation in Chicago. The corporation is authorized to rent privileges of stringing cables on its poles. The ordinance passed the Council by a vote of 21 to 11. From an interview with Mayor Harrison it is learned that he will sign the ordnance.

The Court of Appeals has granted the motions recently made on behalf of the Western Union Telegraph Company to advance on the calendar the appeals taken by the company from the decisions of the General Term of the Superior Court in the Hatch and Williams litigations. The appeals will now be heard in June, thus saving at least a year's delay.

Telegraphs in China are soon to receive an important extension. A line is to be built from Canton to Shanghai. When this line is completed the southern port will then be in direct connection with Tientsin. Lead ore has been discovered in Kwarntimgs, where Canton is situated, and it is proposed to work mines of this metal. It is gratifying to learn that both these movements are of Chinese origin.

Note on the Influence of Surface-Condensed Gas Upon the Action of the Microphone.

BY I. PROBERT AND ALFRED W. SOWARD.

One of the theories advanced to account for the action of the microphone states that the layer of air between the microphonic surfaces acts as an ordinary resistance, that the effect of sonorous vibrations is to cause the carbons to approach and to recede from one another, and so to alter the thickness, and consequently the resistance, of the interposed layer. This variation of resistance produces the variation of current essential for the reproduction of sound.

There is in physics a phenomenon known as heterogeneous adhesion, one phase of which is the surface condensation of gases. A study of this phenomenon shows that every surface exposed to a gas is coated with a condensed layer of that gas. The more readily the gas is liquefiable by pressure the greater is the quantity condensed, and in the case of the very readily liquefiable gases the exposed surface is actually coated with a layer of liquid.

Our atmosphere, as is well known, consists mainly of nitrogen, oxygen, carbon dioxide, and water vapor. Careful experiments with charcoal (a substance which, owing to its porous nature, possesses a very large surface relatively to its mass) show that the coefficients of surface condensation of these gases (that of hydrogen being taken as unity) are 3.5, 4, 15, and 80 respectively. These figures multiplied by the figures representing the proportions in which the gases exist in the air, viz., 79, 21, .03, and (say) 1.5 give the proportions in which the substances exist in the condensed layer. They are: Nitrogen, 276.5; oxygen, 84; carbon dioxide, .12; and water vapor, 120. Of these four gases the first two, oxygen and nitrogen, would be condensed without liquefaction, and the effect of this condensation would be to slightly reduce the electrical conductivity of the layer, for it is known that the conductivity of a gas is decreased by condensation; the carbon dioxide would probably be liquefied, and the effect of its liquefaction would be (slightly on account of the small quantity acting), to increase the conductivity; the water vapor would certainly be liquefied, and the effect of its liquefaction would be to very considerably increase the electrical conductivity of the layer. The effect then of this phenomenon of surface condensation is to coat the microphone surfaces with a layer of far better electrical conductivity than ordinary air.

In order to test the influence of this layer of condensed air upon the action of the microphone we have lately made some experiments with the instrument in different gases. The gases used were hydrogen, carbon dioxide, wet air and dry air, and our method of experimentation was as follows:

A microphone of a well-known pattern, consisting of a glass tube containing cylindrical carbon blocks and having many contact surfaces, was attached to the inside of a clock-case and placed in circuit with a Hughes' audiometer, a Morse key and three Leclanché cells. The carbon blocks of the microphone were pressed well together so as to avoid as far as possible alteration of contact due to chance vibrations. A current of air, dried by passage over pumice-stone soaked in strong sulphuric acid and then over pentoxide of phosphorus, was urged through the microphone for half an hour.

The resistance of the microphone was then measured, and the point of the audiometer scale determined at which the beating of the clock became inaudible in the telephones. A current of similarly dried hydrogen was then passed through the microphone for half an hour, and the resistance again measured and the point of silence determined in the audiometer.

The experiment was next repeated with carbon dioxide, the dried gas being passed through the microphone for a similar period; and, finally, for fifteen minutes, a current of air was forced through water contained in Woulffe's bottle (in order to load the air with water vapor) and then through the microphone.

The resistances and points of silence in the audiometer were determined as before.

Our results are expressed in the following table, and it may be noted that the scale of the audiometer was graduated from 0° in the center of 100°:

NAME OF GAS.	Resistance of microphone in ohms.	Point on scale of audiometer at which silence was reached.
Wet air.....	386	51°
Carbon-dioxide	495	56°
Hydrogen.	600	58°
Dry air.....	520	63°

It will be seen that the best result was ob-

tained with wet air, which calculation shows should give a good conducting surface layer. Next in order is carbon-dioxide, which, in the liquid state, is a moderate conductor. Hydrogen comes next, as would be expected, for neither it nor dry air is reducible to the liquid state by ordinary surface condensation, and the best result is to be looked for from the less condensable of the two—that is, hydrogen. The resistance of the hydrogen-charged microphone is, however, anomalous.

In order to obtain our layers of condemned gas, we considered it sufficient to pass a stream of the desired gas over the microphone for some time, because it is known that when a piece of carbon charged with one gas is placed in an atmosphere of another the two gases diffuse into one another with a result that the carbon remains charged with a mixture in the proportion indicated by multiplying their percentage volumes by their respective condensation coefficient. In our experiments the quantity passed through the microphone in any one experiment was vastly greater than the residual gas from previous experiments.

We did not attempt to rigorously exclude water in any of our experiments, for it has been shown that the last trace of water so obstinately clings to a surface that to perfectly dry a glass tube it must be raised to the softening point, and so kept for some hours while a stream of dry air is urged through it.

In these experiments with different gases there is a possible source of error which must not be overlooked. We have elsewhere shown (*Chemical News*, Vol. xlvii., p. 157) that the resistance of a porous piece of carbon is not a constant for a given temperature, but varies with the chemical nature and with the density of the gas with which the pores of the carbon are filled. It follows from this that, if a constant electromotive force be used, the current flowing and the sounds obtained will be altered by any alteration in the nature of the gas absorbed in the body of the microphone, irrespective of the contact surfaces. But the carbon used for our microphone had very little absorptive power, and its resistance was practically constant at contact temperature.

We think from these experiments it is fair to infer that the layer of condensed gas with which every microphone surface is covered is concerned to some extent in the regulation of microphonic action.

As bearing upon the effect of a layer of moisture, we may notice the following experiment:

A common tin canister, joined through a rheotome to one pole of a four-cell Grove's battery, and held in the hand by an insulating handle, was pressed against the ear; a wire attached to the second pole of the battery was held against the tongue. Sounds were heard corresponding to the working of the rheotome, and a burning sensation was experienced at the ear, such as one might imagine would be produced by innumerable small electric discharges. Similar results were obtained with a ten-cell Daniell's battery (chamber pattern). The surface of the canister, which, having been exposed to the air, was coated, as all similarly exposed surfaces are, with an invisible layer of moisture, was then well wetted. The burning sensation became more marked, but the sounds of the make and break were no longer audible. We may add that a solid brass ball, whether wet or dry, gave no sounds in this experiment.

The telephone line between York, Columbia, Lancaster and Harrisburg was opened for business on the 2d inst.

It is said that the telephone is very popular in Colorado. By means of the telephone, an absent-minded stranger, while talking to a native, can feel in his hip-pocket for a handkerchief or piece of tobacco without being shot. It is thought that very soon all conversation in Colorado will be carried on exclusively by telephone.

General-Manager Howard, of the Tropical American Telephone Company, has received a cable dispatch from Mr. Shute, the company's agent in Rio Janeiro, saying: "Bell patent secured. Contract signed. Everything arranged satisfactorily. Will be in New York June 15." This confirms the report of an advantageous contract with the Brazilian telephone syndicate already given.

At the annual meeting of the Pioneer telephone Company the following officers were elected: President, Wm. E. Livingston; treasurer and clerk, Edward F. Coburn; directors, Wm. E. Livingston, E. T. Rowell, H. B. Shattuck, J. W. Bennett, Chas. J. Glidden. A dividend of 10 per cent. was declared. The company now own two wires between Lowell and Boston.

The underground conduit now building to accommodete the telegraph wires of Chicago is so far advanced that one wire of it was tested last week. The conduit is of iron with shelves so arranged as to accommodate a great number of wires and costs some $6,000 to $10,000.

A telephone cable across the Missouri, connecting Omaha and Council Bluffs, has been completed and will be opened for business at once.

The officers of the Western Union Telegraph Company say that the April business aggregated nearly $2,000,000, of which $700,000 was profit, and that the company's books show the stock to be earning ten per cent. per annum.

The output of instruments by the Bell Telephone Company, which averaged 5,000 a month last year, has increased to 6,000 a month this year, and in April the best month in the history of the corporation—it was nearly 7,000.

First Anniversary of the Birmingham, Ala., Telephone Exchange.

On the 8th day of May, 1882, the Birmingham Telephone Exchange was organized, under the management of C. H. Coyen, with only a few subscribers, and to-day, under the efficient management of Mr. B. D. DeForest, its first anniversary sees it a prosperous and growing institution.

When organized it was with much difficulty that Superintendent Cole obtained the requisite number, twenty-five, to establish an exchange in this city. From that time until December 1st, the exchange made but little progress under the management of Mr. Coyen, as there was much dissatisfaction among the subscribers.

On the 1st. of December Mr. DeForest was installed as temporary manager by Superintendent Cole, to relieve, if possible, the embarrassed condition of the exchange. Mr. DeForest met with many difficulties, when he first took charge, and it was only through labor and perseverance that he succeeded in gaining for the exchange the confidence of our citizens. As soon as this was done, the exchange began to grow, and numbers of subscribers were added daily to the list. The increase of subscribers was so rapid that Mr. DeForest was hardly able to promptly fill new orders, so that from fifty-five subscribers, the number on the exchange list on the 1st of December, it has increased to 151, with twenty-five more promised from some of our leading citizens.

On the first day of April, in answer to a petition to General Superintendent D. I. Carson, of New York, signed by all the subscribers to the exchange, Mr. DeForest was installed as permanent manager.

The first anniversary of the exchange finds it to-day with a long list of subscribers—growing daily—under the management of a gentleman who gives it the greatest satisfaction, and finds it the largest telephone exchange in the State of Alabama.

At present Mr. DeForest employs the following force:

Messrs. Leon Collins and Willie Terry as day assistants, and Mr. Joe Levitt as night assistant. Mr. LeRoy Baker is employed as chief lineman.

The office is located in the Terry Building, corner of Second avenue and Nineteenth street.

The capacity of the switch-board used at present is 200 wires, which, owing to the rapid increase of subscribers, Mr. DeForest will be forced to discard and substitute another with a capacity of 500 wires, which will be done in the early part of next fall. The number of calls per day average over 1,800, the largest ever made in one day was on Saturday, the 5th instant, which was 2,210.

Mr. DeForest extends to the citizens of Birmingham an invitation to visit the exchange on this its first anniversary day, between 10 A. M. and 5 P. M., and will with pleasure receive all visitors, ladies and gentlemen, and explain to them the mysteries of the wonderful machine that can bear to ears miles and miles away the softest whispered words.

The telephone exchange is an institution whose usefulness has gained for it the patronage of a great many of the citizens of Birmingham. With it the subscriber can summon, at any hour of the night or day, in a moment's time, a physician to heal and cure, or a police officer to give protection; and, what is better still, as there is now an instrument in the City Hall, he can with its aid call out at any hour the fire companies.

The telephone exchange is one year old to-day. The first subscriber to the exchange was Mr. Frank P. O'Brien; the last on the list during the past year was Pelle & Smith.

An underground telegraph line is to be established between Nice and Grenoble, passing by way of National Road No. 85. The wires will be under the foot-path, and will be placed 25 centimeters beneath the surface.

Lausanne, Switzerland, has had a telephone system in regular operation for about three months and a half, 100 subscribers are actually connected, and the installation has been arranged to accommodate 600. The service is continuous by night as well as by day.

Electric Light News.

The American Electric Co., of New Britain, Conn., has changed its name to the Thomson-Houston Electric Company. The new name brings the inventors of the lighting system owned by the company more prominently forward. This system of arc lighting makes high claims to public attention, as possessing many valuable features. The New Britain company lately passed into the control of capitalists near Boston, who have changed its name as above, and have organized several subsidiary companies that are now using the Thomson dynamo machines and lamps with great satisfaction, especially in Boston, Lynn, Fall River, Hartford, Utica, Kansas City, Leavenworth, etc. The factory remains for the present at New Britain, but a large new factory is in progress at Lynn, which will be occupied by the company the present season.

What they call a "frontal electric photophore" for medical use has been produced by MM. Helot and Trouvé and described before the French Academy. Essentially it is an incandescent lamp, which is supplied by a bichromate battery and fitted with a reflector and convergent lens. As the name implies the instrument when put into practice is applied to the forehead.

Microscopes have been tried with the Swan incandescent lamp, instead of the ordinary oil one, and with marked success. A small lamp of two or three candles in power is rigidly attached to the microscope, and then the current is sent through at will, giving a pure light without any of the drawbacks of great heat, smell, unsteadiness of any kind, or any necessity for cleaning.

According to a report read at a meeting of the stockholders of the Edison Electric Light Company of Europe, Limited, there are in France 32 plants of the company with 2,680 lights; in Italy, 11 plants with 5,777 lights; in Germany, 28 plants with 3,667 lights; in Holland, 4 plants with 1,648 lights; in Austria, 7 plants with 1,724 lights; in Russia, 14 plants with 2,772 lights; and in Belgium, 12 plants, with 1,268 lights. A subordinate company has been formed in Germany, and the interests of the Edison and Siemens lights have been consolidated under the name of the Edison Electric Light Company of Germany. The capital of the company is 5,000,000 marks. The capital of the General European Company is $2,000,000. The subordinate company recently formed in Italy has a capital of 3,000,000 francs. It was stated that an Edison factory, similar to those in this country, had been established in Italy, for manufacturing dynamo lamps, underground conductors, meters, and other apparatus for use by the European Company, exclusive of Germany, where the Siemens and Edison companies manufacture apparatus under separate licenses. A company has just been formed to introduce central station lighting in Paris on a large scale, and a central station similar to the one in Pearl street will be built. A central station is also starting in Milan, Italy, where La Scala Opera House is lighted by Edison lamps.

Our esteemed contemporary, the *Tribune*, has tried two systems of electric lighting. The first system, we are told, did not give satisfation, and was retired. The second gave satisfaction, but retired when the Jablochkoff light stopped. They are now using gas to write their editorials by. Where are Edison and Swan?

Mr. Dunand, a distinguished French electrician, has recently died of *phthisis pulmonatis* at the age of 42 years. He was the inventor of a system by which an ordinary condenser could be made to talk in a telegraphic circuit, and had invented several ingenious adaptations of the microphone. He directed an establishment for education in the sciences.

The pleasure yacht Yedda belonging to Mr. Edmond Blanc, of Monaco, has been illuminated with incandescent electric lights.

The new palace of King Ludwig II., of Bavaria, at Neuschwanenstein in the Bavarian Alps, which is one of the finest castles in Europe, is entirely lighted by electricity. Jablochkoff lamps are used for the exterior and Swan and Edison lamps for the interior of the edifice.

The project of lighting the Canton of Vaud in Switzerland by electricity is the object of the studies of several engineers at Lausanne. To furnish the necessary power a station will be erected at Vallorbes, near the sources of the Orbe, and the waters of Lakes Joux and Brevet will be utilized. This body of water, secured not far from the mills of Bonport, will be carried to Vallorbes by means of a tunnel 800 meters long, which will be cut under Mount Orziéres, and will be delivered in the neighborhood of the rocks near the sources of the Orbe. The quantity of water which will be thus placed at the disposal of the engineers will be about 2,500 liters, will fall for about 200 yards, and will thus furnish to the turbines of the station a force of 500-horse power, which is sufficient for 25,000 electric lamps.

The Court Theater at Dresden is to be illuminated with Edison lamps.

The Siamese Government has concluded a contract with the Eastern Extension Company for the establishment of terrestrial telegraph lines and the laying of submarine cables, which will constitute a double line from China and other countries to Singapore. The new route will include a cable from Penang to Quedah, then a land line across the Peninsula to Singora, on the Gulf of Siam. From Singora a cable will be laid across the Gulf to Bangkok. The French Government will connect Bangkok with Saigon by a telegraph line through Cambodge.

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Those desiring to recommend their goods can do so to any extent in our advertising columns, but we will not publish for pay anything of that nature in our reading columns.

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Cambridge Buncombe.

Upon the title-page of a recent number of our esteemed contemporary, *Science*, appeared an open letter, addressed "To the Educated People of the United States," wherein the aforesaid "educated people" are called upon to subscribe to a new journal, which, it would seem, is to supersede the present publication of the same name.

Coming from anywhere else but Boston, or its classical neighbor, Cambridge, the promises made for the new journal, as set forth in this prospectus, would be regarded, to say the least, as extraordinary. We are told that "its contents are to be in extreme contrast with the majority of publications of the day." And why? Because they are to be "of the highest character," "to be printed handsomely and accurately," "to be written by a thoroughly competent person, who is to be paid for his work;" "not a single 'puff,' or any kind of notice of anything, is to be printed for money-making purposes."

Principally for these reasons, we are told, in conclusion, that "it seems, therefore that the enterprise is worthy of the active and positive encouragement" of the aforesaid "educated people."

We are inclined to think that this letter, at least, was not written by the "thoroughly competent" person referred to by our contemporary; or, if such was really the case, that he is now only taking a little preliminary practice before beginning his contemplated work of putting to the blush all the contemporary writers upon scientific themes. We hope we shall not be set down as "thoroughly" incompetent by the Cambridge sages if we acknowledge that we don't see how anyone could give their projected enterprise "active encouragement" without, at the same time, giving it "positive" encouragement, nor do we see any reason for the evident apprehension of the writer that some one will give the enterprise negative encouragement.

He goes a little too far when he assumes that the majority of publications of the day are written by incompetent persons; that these persons are not paid for their work, and that such contemplated payment will be an innovation in journalism. His assumption that "the majority of publications of the day" admit "puffs" in their reading pages in such manner as to deceive the public indicates either a lack of familiarity with the subject he essays to discuss, or a wanton distortion of facts, and we call upon him to prove his assertion.

Those familiar with metropolitan journalism would be greatly amused were they to learn that a Cambridge publication proposed to revolutionize journalism by paying the public writer for his work The fact is, that "the majority of publications of the day," both scientific and popular, are, at all times, willing to pay liberally for good work. A large corps of young men, many of whom possess the highest degrees of English, Scotch and American universities, make good incomes in such employment, and the coming scientific venture at Cambridge will be exceedingly fortunate if it procures as good work as is now being done by these men; and, notwithstanding its high-sounding prospectus, it is not at all probable that it will obtain better.

We have seen pills advertised to cure nearly all the maladies to which human flesh is heir. The great cures of eminent practitioners were to be thrown into the shade, surpassed. Some people were cured by using them, some were cured by their belief in their efficacy, and others found them to differ but little from other pills, the qualities of which had been similarly proclaimed. So it is with that which is announced by the average prospectus. It will not set the Thames a-fire.

It is always praiseworthy to strike out boldly in the path of advancement and improvement, but thus to pursue perfection is, like the first inhabitants of Arcadia, to chase the sun, which, when they had reached the hill on which he seemed to rest, was still beheld at the same distance from them.

The projectors of the coming journal have our heartfelt good wishes.

We hope that they will be entirely successful in making a readable and accurate journal; that they will secure the services of thoroughly trained writers, as the managers of the ELECTRICAL REVIEW have done, and be at all times prepared to compensate them for their work, as they are; that they will never admit, save in those columns specially set apart for advertisements, anything of a semblance to "puffs;" and lastly, that they will never again have resource to the clap-trap prospectus.

Who Should Own the Telegraph?

A person named Col. Price recently addressed a meeting of the Scranton Board of Trade on "Governmental Control of Electric Communication." If the report of what he said, now before us, may be relied upon, Mr. Price must have spoken for several hours, and, considering the wide field he sought to cover, we think a more applicable title to his discourse would have been "A Dissertation upon Things in General, with an Occasional Raid on the Present System of Telegraph Communication"

Mr. Price, or rather Colonel Price, is characterized as "well-known," but we are not told where or for what. If it is for verbosity and garrulity we are not surprised. His argument in the present case is as illogical as his characterizations are stupid and tiresome. We would have found no fault with him had he made a manly, straightforward attack upon the Western Union Telegrah Company, sustaining his argument with proof step by step, that it was unreliable and more apt to defeat than to serve the best interests of the public. This we say we would have found no fault with if proof could be adduced to make good such an allegation, of which there is very serious doubt. But instead of this, he complains of the Western Union Company because it controls the telegraphic business of the country and whines and snivels because it pays large dividends.

There is, of course, much to be said on both sides of this question, but such discussions as that referred to do not rise to the height of argument and overlook the more important aspects of the case. It is of trifling public consequence whether Western Union earns its dividends or not. The mass of people are not concerned if some few thousand messages are delayed, and the ordinary American citizen is quite indifferent as to whether the telegraphic service is controlled by W. H. Vanderbilt, by Jay Gould or by any other capitalist. If corporations or individuals are to own this indispensable agent of modern business and intelligence, then it is a mere matter of whim or personal liking as to which or who it should be.

Every civilized nation, save alone the United States, makes the telegraphic system a part of the postal service. It has been found by experience that this Government monopoly is, on the whole, a good thing for the general public. The service is more efficient in Europe than it is in this country, and the rates are far lower. It is quite true that our own tariff of rates has been and is being steadily reduced. It is also true that the differences between commercial centers are greater on this continent than in Europe. But, while making these allowances, the fact still remains that the people of the Old World have a great advantage over us so far as cheapness, expedition and responsibility go.

Theoretically all the arguments are on the side of the Government assumption of the telegraphic service. It is properly a part of the postal system. Business men are beginning to rely almost entirely upon the telegraph for their commercial correspondence. Were there no wires, the letter mail service wou'd be immediately quadrupled, and would it seem improper that the agency by which news is transmitted and the prices of all the markets of the world recorded should possibly be made the foot-ball of speculation in Wall Street? Electrical communication has become as indispensable to the daily business of the country as air and water are to the human body.

This is one side—this the argument for the plaintiff, the People. Let us look at the other. Experience has proved that, under a republican form of government, the smaller the office-holding class the less there is of corruption. The post-office department, which must necessarily be conducted by Government, represents one hundred thousand office-holders, most of whom are political appointees, and, holding their position by reason of political favor, must support the ruling administration. Now add to this the railways and the telegraph, and this number would be doubled, trebled, and possibly quadaupled. Under such a condition of things, with such a large number of firm supporters, it is doubtful if even an unpopular political party, though greatly in a minority, could be got out of office when once its minions were securely established.

There are other and equally cogent reasons, which will readily occur to the reader, why the telegraph should not be operated by Government, and, though Mr. Price had been a very giant of argument, he could not have disproved the unwisdom of any scheme looking to Government control of the telegraph.

Automatic Telegraph.

The introduction of the Wheatstone Automatic Telegraph into this country has revived the question as to which of the various automatic systems is the most generally serviceable.

These are the automatic systems now used by the American Rapid Telegraph Company, the Leggo Automatic Telegraph as used by the Postal Telegraph Company, and the Wheatstone.

The two former systems may be termed chemical automatic telegraph, and the latter a mechanical automatic system, as distinguishing the respective methods of each.

We shall consider some of the principal failings and advantages of each system, leaving the reader to form his own opinion thereon. It is generally known that the Wheatstone and American Rapid systems use in the transmission of messages prepared perforated paper. In the latter system needles pressing on the paper make contact through these holes, thus closing the circuit. In the Wheatstone a pair of needles also press on the paper, but do not make direct contact with the main circuit. Instead they, as each combination of perforations pass, operate by means of light springs a sensitive pole changer to which they are attached.

In the Leggo system the transmitting apparatus consists of a steel cylinder or drum on which dots and dashes of the Morse alphabet have previously been stamped with insulating ink.

The steel cylinder or drum is a part of the main circuit, and while a needle (which is a continuation of the main circuit) is passed over the ink the circuit is kept open, but it is closed while the needle makes contact on the clear spaces between the dots and dashes.

The receiving apparatus of the Leggo and American Rapid Automatics are almost similar. Chemically prepared paper is run over a steel roller, which is part of the main circuit. A steel needle, also a part of the main circuit, is placed against this paper, and as the paper, by reason of its moist condition is a conductor of electricity, it likewise forms a part of the circuit. When a current is passing through the paper electrolytic action takes place and a mark is recorded corresponding in width to the size of the needle point, and in length to the duration of the current.

In the Wheatstone system the receiving instrument consists of a delicate polarized relay, the armature of which responds to the changes of polarity at the sending end, and records a mark in ink on the receiving paper at each upward stroke.

It is thus apparent that the speed of the mechanical automatic system is limited to the frequency with which the polarized relay may be magnetized and demagnetized, and

at the same time allow its armature to record its signal plainly. In the case of the Wheatstone relay this is about 250 words per minute, although the number of words varies according to the sensitiveness of the receiving instruments, some being more so than others. The maximum, however, may be set at 300 words per minute.

In the chemical systems there is scarcely any limit to the speed at which signals may be sent, as it simply depends on the rapidity with which the circuit may be opened and closed, as at every closing thereof a signal will be recorded. The Leggo system claims to be able to transmit 3,000 words per minute.

A current of electricity through the prepared paper of the chemical automatic systems is necessary to the recording of a signal. A flow of electricity on the wire from any other source than the transmitting battery, such as from induction, leakages from other wires, etc., will also be recorded on the paper, and this fact constitutes one of the main difficulties met with heretofore on the chemical automatics, as it has often rendered message after message illegible.

The postal telegraph people with their compound copper and steel wire, isolated from all other wires, consider that they will have little or no trouble from the above causes, and it certainly would appear that such a wire should obviate this fault in a great measure.

Another source of serious trouble on the chemical systems arises from the very fact of its rapidity, namely, that as the signals arrive so quickly it is impossible to follow them with the eye as they come in, even if the annoying danger of tearing the moist receiving paper in the handling were not present, consequently the messages are rolled on spools as they are received, and are afterwards taken away to be transcribed, when it is frequently discovered that errors and false signals have crept in, including occasionally, perhaps, half a dozen or more messages. To have these messages corrected and repeated, which work is mostly done by the Morse telegraph, consumes much time, and necessitates the use of the wire and the consequent stoppage of business in the meantime. Of course, for the reason that a current of electricity would be constantly on the wire the chemical systems cannot be used on duplex or quadruplex circuits.

In the matter of preparing messages for transmission by the automatic telegraph, the Leggo Company claim an advantage in the fact that by their method city branch offices, as well as any outside offices having business for points reached by the automatic system, can as well stamp the said business directly on to the automatic transmitting drum or cylinder as at the main office, whereas on the other systems all such messages have to be first received in the ordinary way and then perforated for transmission by the automatic system.

The ability to do as above by the Leggo system is undoubted, but its utility is a question for experience to decide.

Bewteen the comparatively slow Morse manual method and the very rapid chemical automatic systems the Wheatstone Automatic Telegraph would seem to be a medium. As its speed rarely exceeds 200 words per minute, a skillful reader can follow the characters as they arrive and detect at once any trouble or mistakes when they occur. These mistakes or errors may be corrected also without stopping the receiving apparatus—for the Wheatstone can be, and generally is operated on a duplex wire—which is undoubtedly a decided avantage.

The Wheatstone system, then, while, by reason of its more sensitively constructed instruments, being somewhat more liable to induced currents or slight wire contacts than the Morse telegraph, is not so much affected thereby as any of the chemical automatics would be. The fact also that it can be operated on a duplex wire gives it practically a speed of, say, 500 words per minute on one wire, and when it is considered that this work is received on dry, stiff paper, in clear and legible Morse characters, without the "space" dash required on the Rapid and Leggo systems, and is verified as it is received, the advantage will be readily admitted. But only those who have had practical experience in transcribing from the wet, easily torn and frequently illegible paper of the chemical systems can properly appreciate this advantage.

As regards the manner of preparing messages for automatic transmission, it is probable that the American Rapid system, with its pneumatic key-board process, is superior in point of speed to either the Wheatstone or the Leggo systems. The speed of the Leggo depends, as in the ordinary Morse sending, upon the dexterity of the operator, but it may be considered to stand second in this respect, while the Wheatstone, with its cumbersome "punching apparatus, ranks next.

As the Leggo system has not yet been fairly tested, and as some of its best points may still be withheld, it would, perhaps, be premature to pass decisively on its merits at present. However, as between the practical utility of the mechanical and chemical automatic telegraphs, as represented by the Wheatstone and the American Rapid systems, respectively, we think that the evidence is rather in favor of the former.

We will take occasion here to correct a statement that uninformed people sometimes make, namely, that, in the operation of an automatic system, the handling of a given amount of business requires no more operators than would be necessary to move the business by the Morse method. This is a mistake, for, even if we admit that one perforator and one transcribing clerk can prepare and transcribe as many messages during one day as can be sent and received by two Morse operators in the same time, we still have to add to the automatic staff the clerks or operators attending the automatic instruments at each end.

But it is not the case in actual practice that a perforator and a transcriber can dispatch as much business in a given time as can two Morse operators. This will be apparent when we state, as we have been credibly informed, that but four Morse operators have been dispensed with on the Chicago Morse circuits since the introduction of the Wheatstone automatic circuit between New York and Chicago, in the Western Union building, while some fifteen people are employed in the Wheatstone department to do the work formerly performed by these four Morse operators.

It should be observed that this disparity will not be so great when the Wheatstone staff has obtained more experience with its work.

It will be readily admitted, however, that by the automatic systems as much business may be transacted on one wire as can be done on from seven to ten wires by the Morse method, and were it not for the greater liability to make errors even on the best of the automatic systems, as well as the greater average delay attending the delivery of messages by these systems, there is no doubt that the automatic telegraph systems would long ago have superseded the Morse telegraph system, at least between all the large cities.

At a meeting of the New England Cotton Manufacturers' Association recently, it was stated by one of the speakers that since the last meeting, six months ago, there has been no improvement in quality or price of electric lighting. The position of the underwriters has generally been acceded to, and during the past year there have been no accidents on account of the use of the light. About one mill in fifteen insured in the Mutual companies is now lighted in whole or in part by electricity. With proper precaution, that is now the safest form of artificial lighting. The necessity was urged for testing frequently an electric light system, just as the pressure or steam in a boiler is watched.

We learn from Mr. John J. Ghegan of the telephone company at Monterey, Mexico, that the telephone business and electrical projects in general are on the boom there, and that the telephone is looked upon with special favor.

Electrical Notes.

Villages and hamlets that were heretofore cut off from the telegraphic world, are now connected therewith by means of the telephone.

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The gain in this direction is a very decided one in all respects.

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An expensive delivery charge, and oftentimes serious delay in that service, will be dispensed with.

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This does away also with another, and a potent argument, as to why the Government should take charge of the telegraph.

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There is still something further to be done. The telegraph companies have the standing order, "Messages transferred by telephone at the sender's risk."

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Improve the speaker and abolish the risk. With the number of workers in the field, this, of course, will be accomplished ere long.

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The telephone has simply opened up a new field of industry for itself.

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The very little heat that is given out by the electric lamps should make it a particularly desirable light for the warm weather, when coolness is such a desideratum.

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What would the printer do without his em, or the electrician without his ohm?

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It is claimed that the sum of $2,500 has been offered as a premium by a gentleman in England, to anyone, either in or out of the United Kingdom, who shall during the present year invent a portable electric or other lamp, which working miners can conveniently carry from place to place in the mine, and which will not, under any circumstances whatever, cause an explosion of gas.

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Prof. Sylvanus P. Thompson, in a recent paper in the *Journal of the Society of Arts*, inferentially predicts great things for electricity afloat.

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He says that, though the skeptics, as usual, will urge all sorts of objections to such applications of electricity, that they were wont to do when it was proposed to use steam in the same way, they will finally have to concede much that has been promised for the new motor afloat as well as ashore.

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For it is well known, as he says, that no less an authority than Dr. Lardner publicly pronounced it impossible for any steamer ever to carry coal enough to enable her to cross the Atlantic. It is also recorded that a very eminent public man offered to swallow the boilers of the first steamer that should succeed in crossing the Atlantic. He would, however, be a bold man nowadays who would promise to swallow the accumulators or the dynamos of the first electric boat that shall successfully make the same trip across the ocean.

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We are glad to learn that the young electrician, Mr. C. J. Kintner, late chief clerk in the Department of the Interior, has been promoted to the position of principal examiner in charge of the class of electricity in the Patent Office, lately made vacant by the resignation of Mr. Freeman. This is a deserved recognition of faithful service and ability.

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Arrangements have been made for the visit early in June to the Clifton House, Niagara Falls, of a large party of distinguished Mexicans, who will be escorted by General Grant. In honor of their visit, there will be a display of fireworks and an extra electric illumination at the Falls, which, no doubt, will delight the Mexicans.

One of the greatest difficulties, and also a great source of annoyance, connected with the telegraph service, is in procuring answers to dispatches.

The sender always considers his communication of the utmost importance, and does not stop to ask himself whether or not the receiver will look at it in the same light.

Hence, when the reply fails to come at the desired moment, the service is at fault, and you cannot convince the impatient customer to the contrary.

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As a matter of fact and every-day experience, the recipient of a dispatch generally consults his own convenience, or his own view of the urgency of the matter, in attending thereto.

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An irascible old gentleman on one occasion kept sending message after message to his daughter, until he had sent three. Each one required to be answered immediately, and each one failed to bring any response.

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He at first listened with a show of patience to the explanations that were offered as to the probable cause of delay. If his message had not been delivered, he would have been notified, as was the custom and according to the rules of the company, but he knew better than that. Then he became wrathful, indignant, and finally abusive of all corporations; said, if a man wanted his business done properly, he would have to build a line for himself, which he felt very much like doing.

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Shortly after he had left the office, the answer came which had been sent to him, and which informed him that all his telegrams had been received, and that she had replied fully by mail—had sent two letters.

He forgot to call around again and apologize.

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The telephone, however, is going to correct all this. That is, perhaps it is. The novelty, however, of answering on the telephone is gradually wearing off, and it may not be a great while before it will be as hard to get the person wanted to give a responsive ear to that instrument as it has been to get the sought-for replies by wire.

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"Can't raise them" is beginning to be heard with at least noticeable frequency on the telephone lines.

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Occasionally a party is met with who can get along without the heretofore inevitable "hello." When the bell rings, he simply inquires if this is the office he has asked for, and then proceeds. It would seem as if the "hello" is a more necessary adjunct of the person than of the telephone.

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Those who begin their conversation by the inquiry, "Who is it?" "Who am I talking to?" show a great lack of knowledge of human nature. The first impulse of the individual thus interrogated is generally a response to the effect that "it's none of your business." It's an infringement on a man's patent right on his own freedom The proper way to do is to begin by making your own identity known—"I'm Watkins. Who are you?"

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It is seriously recommended that hotels should put a card in every room, cautioning guests against the dangers of blowing out the gas. What they should be advised to do instead, however, is to blow out their gas-meters, and substitute the electric incandescent therefor. This is what is needed, and what is sure to come to pass, too, before many moons.

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The United States Electric Railway Company of New York, which controls the combined patents of Mr. Thos. A. Edison and Stephen D. Field, is building an electric railway one-third of a mile in length running around the gallery of the Exposition Building. The road will be in operation during the National Exposition of Railway Appliances at Chicago.

Among those who are giving intelligent thought to the electrical problems of the day is Lieutenant Bradley A. Fiske, U. S. Navy. This officer contributes to the current number of *Van Nostrand's Engineering Magazine* a paper upon "Electric Potential, Energy and Work," which is at once interesting and instructive. His suggestion that it is not well to have the same unit, the erg, for both energy and power, indicates, on his part, the possession of a clear, level-headed perception that older, if not more experienced, engineers than himself would do well to cultivate.

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For a people having entire confidence in their own powers, commend me to the English. A committee of the London Board of Trade has been appointed to determine the relative merits of oil, gas and electricity.

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This is really too good! Oil has now been in use in the lighthouse for something beyond the recollection of men now living, or even of their great grandfathers; electricity has been used to light the French coast since 1862 with the greatest success. Masters of ships have testified that electricity in the lighthouse has enabled them to enter harbors at night during the prevalence of a gale of wind; whereas, under the old system, so obscure were the landmarks that they were compelled to put back to sea again.

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Again, mariners have testified, and experiment has confirmed the assertion, that the electric light can be seen in cloudy weather farther than equal candle-power of oil-lamps. The French Admiralty has had exhaustive reports published of the most minute details of electric lighting, and these reports and the other testimony taken all go to prove beyond peradventure that electricity, though more expensive than oil-lighting, is far more effective and efficient, and, therefore, in reality cheaper, since there would be no economy in curtailing the luminosity of coast lights.

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Upon the very face of the proposition gas for coast lighting is out of the question to the mind of any one but a pronounced landlubber, because it is likely, through many causes, to fail at the very moment when it is most wanted. In the dwelling-house or the public thoroughfare, it is not of vital consequence if the gas should suddenly stop for a few hours; but in a lighthouse, during these few hours when the light was out, a whole fleet might run ashore, trying to get within the range of visibility of the light that should have been aglow.

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Nevertheless, a ponderous committee of Englishmen were to sit on the question, to pore over it, blink at it, snooze over it and finally take a long, deep slumber over it, and then after all, if the experience of other boards of the same make-up is to be relied upon, bring in a verdict that all that they know about the relative merits of these illuminants is that nothing can be known.

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Now, gas in London costs what, in our money, would be only about 80 cents the thousand cubic feet, against $2.25 a thousand, which we pay here in New York. With coal at the same price, therefore, it will readily be seen that, at this rate, incandescent lights would in New York be an economy besides being a blessing.

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A proposition to a Boston electric lighting corporation from parties in Providence, R. I., who represent a large amount of money, for the establishment of a central lighting station and putting in a plant of its system, has been accepted. Work on this new project will be begun at once, and it is probable that the station will start one hundred lamps. Arrangements have also been completed for putting in a plant at Old Orchard Beach this summer, which will light the Old Orchard House and other large hotels as well as the beach. This will increase to a great extent the popularity of this already popular resort, and will probably lead to the more general adoption of this system of lighting at summer watering-places. The dynamo machines and engines will be placed in the basement of the Old Orchard House.

A Patent Vote Enunciator.

Messrs. Williams & Crosby, of Boston, have just secured permission from Architect Clark, of the Capitol, to put in operation an electric registering apparatus. It will not at first be applied to the main hall of the House of Representatives, but will be set up in one of the lower rooms for exhibition before members of Congress. It is an appliance similar to that used for registering the yeas and nays in the French Corps Législatif, but combining some principles with electricity peculiar to discoveries and inventions which are the sole property of Messrs. Crosby & Williams. It will, when in full working order, print the name of the member on a list on the desk of the tally clerk, and at the same time deposit a ball in the box for yeas or nays, as the case may be. The only indication of its presence on the member's desk will be three small buttons, one for the yea vote, one for the nay, and one for announcing the member's presence on the call of the House. A similar contrivance was in operation several years ago, and was the property if not the invention of William R. Springer, of Illinois. It was found to work admirably, the registration being instantaneous, and the requirement that each member should be at his own desk considerably helping along the expedition of business; in fact, it worked too well, and the sticklers for the prerogatives of the minority succeeded in preventing its adoption or retention, and returned to the old method, which served the exasperating purpose of filibustering, as this automatic machine will not do.

Magnets.

In the manufacture of telephone and magneto instruments, there is probably nothing of more importance than the magnet; and therefore the material from which the best magnets can be made is of the greatest interest to the scientific world.

After making some inquiries, we find that the article known as the Chrome cast steel is and has been giving the best satisfaction in the manufacture of permanent magnets.

In a recent visit to the Chrome Steel Works, Brooklyn, E. D., N. Y., we saw the steel in the different stages of manufacture, also unmistakable evidences of the uniformity of the material, which is most necessary.

Chrome cast steel has been and is now being used extensively in the manufacture of magnets by some of the largest and most successful manufacturers of electro-magnetic machinery for several years past, and they testify as to its superiority.

We also had special tests made, by the largest electric company in the country, of permanent magnets made from Chrome cast steel, with the extraordinary result of a test through a resistance of thirty-five hundred (3,500) ohms, which is remarkable, as a magnet holding against a resistance of fifteen hundred (1,500) ohms has heretofore been considered a first-class magnet.

From what we have seen, we do not hesitate to say that there is no doubt that in the near future all permanent magnets will be made from Chrome cast steel, unless some material which will prove superior should be developed.

An experimental test of the new "electro-thermostats" of the Automatic Fire Alarm Association was made at the Morgan Envelope Company's works in Springfield Mass., 26th ult. A little alcohol was burned in the room where the apparatus had been placed, and an alarm was produced in one minute and ten seconds. The plan of the company is to put the thermostat into mills, manufactories, hotels, etc, once in every twenty feet so that wherever a fire breaks out the heat will act on it in such a way as to cause an alarm. It claims that one per cent. on the premiums of the insurance usually carried on a large mill will pay the interest on such a plant as they would put in. The contrivance is an ingenious one, and the electric circuit is completed by heating a bent glass tube, filled at the bottom with mercury, and at the top with a hydro-carbon liquid, so that a part of the latter becomes vaporized and the mercury is forced out of the tube into a cup and upon a wire, which sounds the alarm in the office or any outside building with which it may be connected.

PROVIDENCE, May 13, 1883.

The opening of a new electric light company created considerable excitement here last night, which has not abated to-day, nor probably will not for several weeks to come. The new system which comes in to compete with older established systems of electric lighting is the American Electric and Illuminating Co., of Boston, of which Mr. Edward H. Goff is president.

The Brush Electric Light Company and the Weston system have made great progress since their organization here, and have done considerable street and store lighting, with more or less success, and the new company sliding in so quietly, and yet so steadily, of course, threw the city into excitement, and all Providence came out during the evening to see and compare the lights.

If any reliance can be placed upon public opinion unasked and openly expressed, then President Goff and his company are to be congratulated upon their eminent success. Fully and unsparingly did the unbiased people who thronged the avenue and passed through the Butler Exchange, where the lights are hung, endorse the new lights, which invite criticism for the first time in Providence. The plant now in consists of one 25-light dynamo, run by one 50-horse power Armington & Sims engine, and was put up in running order complete in forty-eight hours. Another dynamo of equal power will be immediately set up, completing the first "series" of fifty lights. Additions to the plant will be made as business demands, and it is more than probable that the company will have three hundred lights out by next December.

Among those who made a tour of inspection during the evening were City Inspector of Lamps Brown and associates; President Goff and Treasurer Smith, representing the company; Mr. G. C. Sims, who built the engine and did so much toward making everything work so satisfactory; Editor Wright, of the *Providence Press*, and Hovey, of the *Manufacturers' Gazette*, Boston, and a large delegation from the Rhode Island Engineers' Association.

After so successful an inauguration, there remains little to be said, except that there is room for a good arc light in Providence, and if properly managed, the new company will find a large, and without doubt remunerative, business.

O. T. R.

Editor Electrical Review:

SIR:—The suggestion of the editor of the *Scientific American* to the printer to wet the floor to overcome electricity is a good one, but it would be better to attach large wet sponges to the ceiling. Electricity cannot live in an atmosphere that holds moisture, besides it is where the moisture "will do the most good;" but little water will be needed, and the remedy constant.

The sponges will be cheaper and more thorough than the brass bar and kobs which you recommended.

The earth is not the grand reservoir of electricity, neither is it a conductor of electricity.

The theory that electricity goes into the ground at Washington or Philadelphia and comes up under the Western Union building is wrong—the explanation is that a wire grounded at both ends is tuned, which is not the case if it is not in the ground.

There is no electricity in the earth for the reason that the earth holds moisture. It would not be a conductor if it held no moisture. Electricity like a locomotive engine must have a track to run on. All electricity and lightning is made at the moment and neither is stored or can be. We can have batteries that are better than others, as we can have a difference in boilers.

Mention is made in the ELECTRICAL REVIEW of a manager who conveyed electricity by connecting a wire from machinery in operation to a carding machine in another room, but there are conditions under which this cannot be done, the metal of the machinery in operation was of a temperature different from the carding machine, and both not being in equilibrio made it seek the other to restore the equilibrium, and this explains the phenomenon of the brass bar and knobs doing the same thing, excepting that the brass works by induction and the wire by contact, the brass and the machinery are at different temperatures and remain so. The frictional electricity is produced by the belting in contact with the pulleys of another temperature. As soon as the equilibrium of temperature is restored the electricity disappears.

A leaden ball in a man's body will do no injury, while a piece of iron will; from the fact that lead takes the temperature of the body, and iron will not, thus producing inflammation.

On the 17th of November last we had what was called an electrical storm. It was over an area of 1,000 miles, extending from New York to Chicago and from Washington to beyond Boston. It was not a storm, but a calm. It was the Indian rummer season, the atmosphere was neither warm nor cold, with rain, the air and the wires were in equilibrio and continued so for five or six hours; during that time the wires were dead. In some offices the different metals of the instruments held the electricity that was generated, injuring them and making their use then impossible. The electricity was on hand, but the wires refused to take it till the equilibrium of air and wire were removed. We see this further illustrated at the time of the aurora borealis in April and September. We have had a warm day, followed by a cool night, and the wires not having cooled we have an effect which we cannot have at any other time, the temperature of the wires being at the greatest possible remove from that of the air the wires are electorized without the aid of batteries and the lines are worked without them.

GEO. LECRONIER.

May 16, 1883.

International Electrical Exhibition—Vienna, 1883.

In order to present to the visitors of the International Electrical Exhibition the literature of all countries respecting electro-technic and electricity, the commission of the exhibition has made an agreement with the well-known publishing firm of A. Hartleben, in Vienna, so that the latter will gather the electrotechnic literature in all languages, and will for this purpose enter into correspondence with all the international publishing firms, as well as the publishers of electro-technical periodicals, etc. An extensive library will thus be arranged in a room adapted as a reading-room and electrically lighted, in such a way that of every work bound exemplaries will be placed in book-cases as exhibits, whereas exemplaries unbound and cut open may be used gratis for perusal. This measure alone might be of great interest for a large part of the public, particularly for all electricians and learned men visiting the exhibition; but it will likewise be of interest for others, as various electrical lighting systems are to be employed in this reading room, and thus the unconcerned visitor will find a possibility of forming his own judgment respecting the utility of one or the other system best adapted for reading-rooms.

The Bowery, although not the most fashionable street in this most fashionable city, is nevertheless the most surprising. It was the first great thoroughfare in New York that adopted the electric light as a means of illumination, and long before magnificent Broadway and aristocratic Fifth avenue became brilliant with electricity, the Bowery was a blaze of light, and poor indeed was the proprietor of a second-hand clothing store or cigar shop who did not hang at least one dazzling globe over its entrance.—*Ex.*

Manufacturing News.

New Machine Shops, Foundries, Hotels, and Mills.

The U. S. Electrical Light and Power Company has just organized at Dubuque, Iowa, with $150,000 capital.

The Capital City Electric Manufacturing Company of Columbus, Ohio, has just organized to manufacture electrical apparatus of all kinds, is to be incorporated.

The stockholders of the Palmer Wire Company of Palmer, Mass., have voted to increase the capital stock from $100,000 to $150,000. The by-laws were amended to provide for the election of five directors, and S. W. French, A. H. Willis and F. F. Bullard of Palmer, L. H. Goodnew of Fitchburg, and Dr. Myron P. Chamberlin of Boston, were chosen The company is overrun with orders, and the mill is busy night and day.

Workmen of the Edison Electric Illuminating Company began last Saturday to put up in the Stock Exchange fixtures for lighting the large board room. They consist of three large, flat, bell-shaped chandeliers, each containing 66 lamps, and will be suspended from the ceiling at about two-thirds of the distance from the floor. Each chandelier has two circles of lamps, each of which connects with a separate circuit, so that the light can be graded. The room has been unpleasantly dark in winter, and not too light even in summer. The innovation has been made at the suggestion of Mr. E. A. Drake, Chairman of the Committee of Arrangements.

The largest check ever drawn in this country was that given by the Pennsylvania Road for the payment of the Wilmington Road. It was for $12,000,000.

Senator J. D. Cameron has purchased the property known as the Lochiel iron works, near Harrisburg, Pa., with the exception of the furnace and pig iron on hand. The price paid is stated at $100,000.

Among new corporations is the Gowan Car Wheel and Tool Company of Chicago, capital $100,000; incorporators, James H. Gowan, A. O. Hall, and Geo. H. Verge.

It is said that the wires of the Staten Island, N. Y., Railroad Company extend from Tottenville to Clifton, thirteen miles. George Black, of Toronto, has attached to one of them an apparatus that he describes as a species of electric condenser, which permits a person to talk through a telephone on the wire at the same time that a telegraphic message is being sent. Although the telephone and telegraphic instruments are in the same room, neither interferes with the other. It is said to be an arrangement somewhat similar to that employed for duplex telegraphing.

"Pickings from Puck" has been pronounced by the leading analytical chemists as perfectly free from any adulteration. The following is the latest analysis: Genuine humor, 90.00; double-distilled wit, 7.50; satire, 1.50; hilarity, 1.00—100.00. Let us compare the above with the New York City Directory, which contains: Humor, 0.75; monotony, 86.25; information, a trace; Smiths, 13.00; 100.00—while, according to the latest analysis of the London *Punch*, there are in that popular periodical: Puns, 25.000; padding, 25.000; Du Maurier's personal friends, 25.000; general gloom, 24.999; humor, 00.001—100. Thereby proving incontestibly that "Pickings from Puck" lays over to an enormous extent, in the matter of humor and other desirable qualities, all other publications. To be obtained, throughout the solar system, Empyrean and vicinity, of all news-dealers.

The Bridgeport Brass Works are experimenting upon some valuable improvements in telephone wire and other electrical ideas. Under the able management of the genial Col. F. W. Mason, this company has made rapid progress toward taking a leading position among the manufacturers who supply the telephone and electric light fields. Among the many specialties that this house have recently put upon the market is a new telephone cord, which is decidedly the most unique that has come to our notice thus far. This cord is made of two courses or layers of fine steel or brass wire woven upon a good quality of twine, which forms a core; over the wire is placed the ordinary cotton and woolen coverings. It will at once be seen that this cord has not the common faults of many now in use. The two conductors, tightly woven one upon another, form a positive contact at all times, and the manner in which it is made reduces the possibility of breakage to a minimum, its firm texture greatly increasing its wearing qualities.

The Mansfield Copper Company of Germany, offers a prize of $1,200 for the best design of a plant to transmit power to a considerable distance underground, 1,700 to 3,200 or more. The conditions are, that the power available shall not be less than ten-horse; and it is left to the designer to employ a motor below ground, or to transmit the power from the surface, upon condition that the rotating parts of the transmission shall not have a speed exceeding 100 revolutions, the cost not to exceed the use of steam power. It is probable that a very interesting series of designs, bringing out the relative points of the various methods of transmitting power, will be offered, there being no restrictions as to the method chosen.

The American Brake Company have broke ground for the erection of a machine shop at St. Louis, Mo. The building will be 130x75, and filled with the latest and best improved machinery.

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Have you received one of J. H. Bunnell & Co.'s new large illustrated catalogues of 1883? If not, send your address by postal-card or letter and you will get one sent by return mail. It contains illustrations, descriptions and the bottom prices of all things telegraphic, including the latest and best designs of telegraph instruments of every description, together with all telegraph and telephone line materials, tools and supplies. We are thoroughly practical in every department, and our manufactures and selections will be found well suited to meet all the needs of improved modern telegraph service. J. H. Bunnell & Co., 112 Liberty street, New York.

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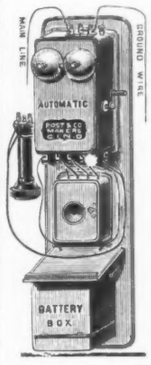

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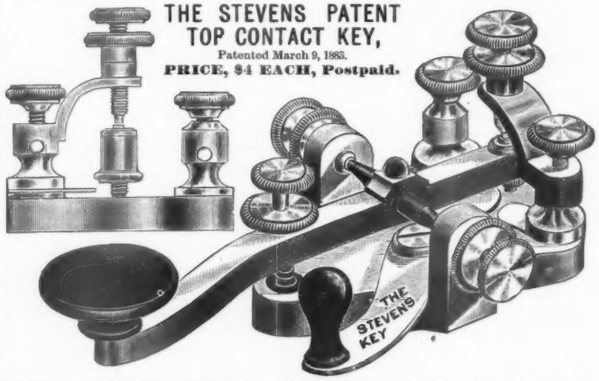

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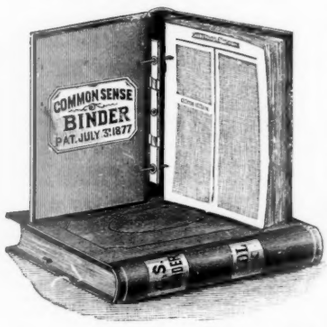

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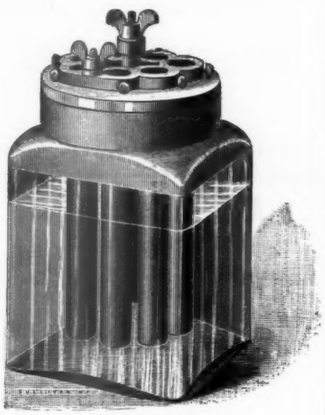

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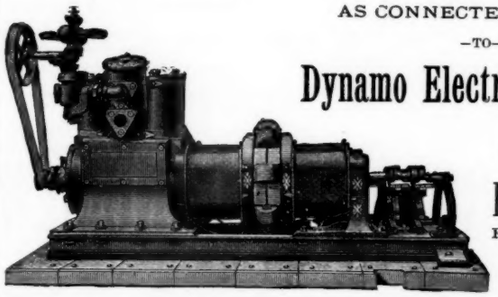

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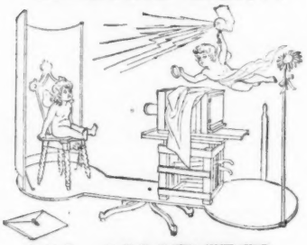

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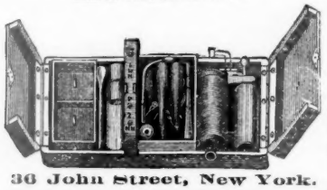

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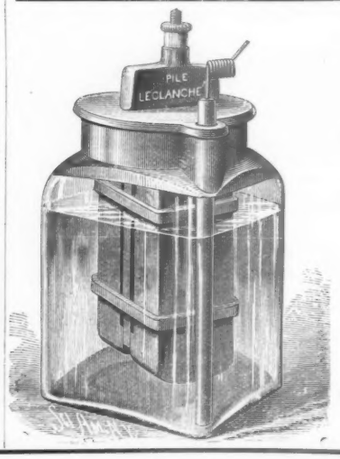

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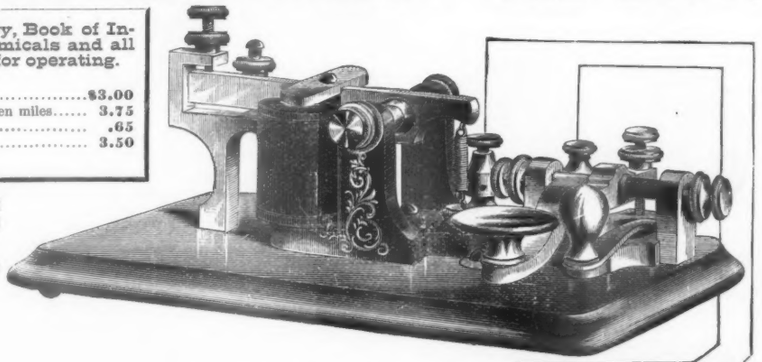

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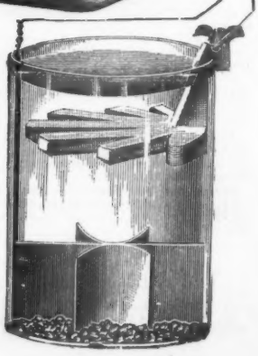

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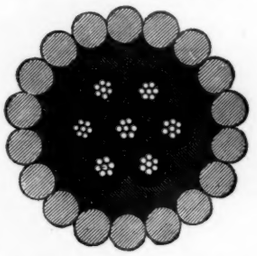

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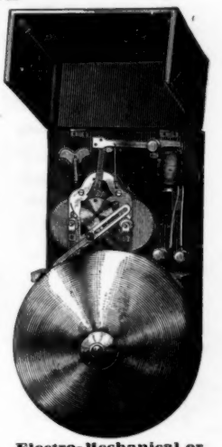

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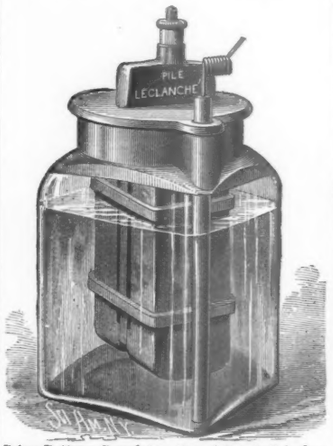

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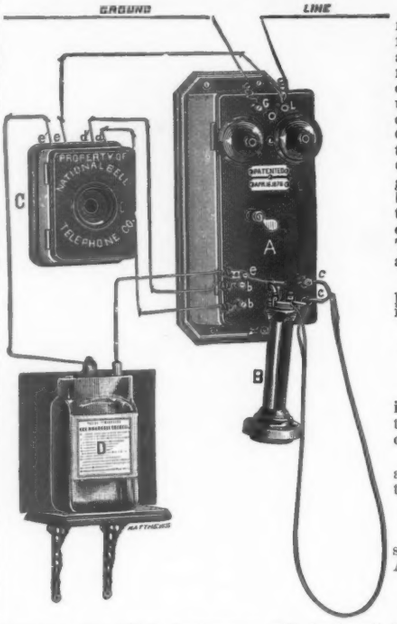

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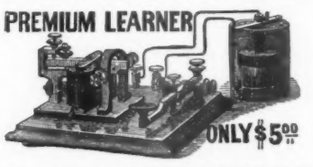

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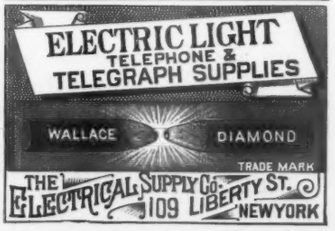
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